3rd India-Japan Symposium on Frontiers in Science & Technology: Successes & Emerging Challenges

60 years
INDIA JAPAN

September 20-21, 2012
Indian Embassy Auditorium, Tokyo, Japan

Program and Abstract Book

ISAJ

Organized by
Indian Scientists Association in Japan (ISAJ)

Supported by
Embassy of India

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Ms. Deepa Gopalan Wadhwa
The Ambassador of India

Honorary Advisor:
Dr. Chadaram Sivaji
S & T Counsellor,
Embassy of India, Tokyo

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Dr. Sunil Kaul

Co-convener:
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एवम्
अध्यक्ष, मंत्रिमण्डल की वैज्ञानिक सलाहकार समिति
(पूर्व अध्यक्ष, परमाणु ऊर्जा आयोग)
Dr. R. Chidambaram
Principal Scientific Adviser to the Govt. of India
&
Chairman, Scientific Advisory Committee to the Cabinet
(Former Chairman, Atomic Energy Commission)

सत्यमेव जयते

विज्ञान भवन एनेक्सी
मौलाना आजाद मार्ग, नई दिल्ली - 110011
Vigyan Bhawan Annexe
Maulana Azad Road, New Delhi - 110011
Tel. : +(91) (11) 23022112
Fax : +(91) (11) 23022113
E-mail : chairman@tifac.org.in
rajachid@nic.in

Dear Dr. Sunil Kaul,

I am delighted to learn that the Indian Scientists Association in Japan(ISAJ) is going to organize an India-Japan Symposium on "Frontiers in Science & Technology: Successes and Emerging Challenges" later this month. Japan is a formidable force in Science and Technology. We from India have watched with admiration its spectacular growth after the Second World War, with leadership in many advanced technologies and also the establishment of advanced basic research facilities.

India also is now emerging as a rapidly growing economy, with inputs from Science and Technology. And the support of the Government of India is rising in all areas of research – basic and applied, in technology development and in innovation. The Government has declared this decade as a the 'Decade of Innovation' and this year as the 'Year of Science'.

India is also looking for international cooperation – bilateral and multilateral - on an 'equal partner' basis. There are examples like the Large Hadron Collider(LHC) in CERN Geneva and the International Thermonuclear Experimental Reactor(ITER) in Cadarche, France. The growing e-research infrastructure in India, exemplified by the National Knowledge Network (a scalable multi-gigabit all-optical fibre, high-speed, low latency network connecting all knowledge institutions in India) will accelerate research collaborations, both national and international.

India has a very long and successful history of scientific and technological cooperation with Japan and there are immense possibilities for the future. I remember inaugurating ISAJ in 2009 in Tsukuba, Japan. I congratulate ISAJ and its members for the high quality of their scientific research in Japan. They are also playing an important role in enhancing scientific and technological cooperation between Indian and Japan.

With best wishes,

Yours sincerely,

R. Chidambaram

(R. Chidambaram)

Correspondence address in Mumbai
Bhabha Atomic Research Centre (BARC)
VI Floor, Central Complex, Trombay, Mumbai – 400085
Tel. : +(91) (22) 25505305 Fax : +(91) (22) 25505132, 25505151
E-mail : rc@barc.gov.in Website : www.psa.gov.in

AMBASSADOR OF INDIA
भारत का राजदूत

11 September, 2012

MESSAGE

It gives me great pleasure to write this congratulatory message for the Indian Scientists Association in Japan (ISAJ) on the occasion of the 3rd ISAJ Symposium on "Frontiers in Science and Technology: Successes and Emerging Challenges" scheduled to be held during 20-21 September 2012. I understand that ISAJ has been playing an active role in promoting Indo-Japan scientific co-operation since its inception through various S & T activities. I am glad to know that ISAJ has successfully completed two annual symposia and this third one, is a signature event to celebrate the 60th Anniversary of India-Japan diplomatic relations.

The theme of the symposium is pertinent to the development and progress of India and Japan and I believe that the new knowledge derived and exchanged among the disciplines and across the institutions would help finding solutions for some of the challenges faced by the mankind and the environment.

I sincerely hope that the scientific deliberations during the symposium would lead to more constructive recommendations for enhancing strategic collaborations between the two countries. I do hope that the Indian and Japanese scientific fraternity would take full advantage of such a unique platform.

I wish the Symposium all success.

Deepa Gopalan Wadhwa

I esteem it is a great privilege to deliver a congratulatory message, on behalf of all of the members of Science Council of Japan (SCJ) for this special occasion of the 60th anniversary of the diplomatic relations between Japan and India this year.

I would like to convey our warmest congratulations to all of the relevant members for holding the India-Japan Symposium on Emerging Technology organized by the Indian Scientists Association in Japan (ISAJ) and supported by the Embassy of India in Japan.

As an academic organization representing 840,000 scientists in Japan, SCJ has been enjoying significant collaboration with our counterparts in India. With Indian National Science Academy (INSA), SCJ shares the memberships of several international academic organizations; such as, International Council for Science (ICSU), InterAcadmy Council (IAC), IAP the global network of science academies, and G-Science Academies' Meetings, for working together with other members worldwide to promote science & technology for our better future. With those channels, science academies including INSA and SCJ issue policy recommendations and function as scientific advisory bodies to the world leaders and publics.

Indian Council of Social Science Research (ICSSR) and SCJ work together as the members of Science Council of Asia (SCA), where a closer and unique framework has been provided for addressing issues in Asia as well as those of global concerns.

As for young scientists, Young Academy of Japan has been established within SCJ, as a committee consisting of young scientists in their thirties and forties. Through the common platform of Global Young Academy (GYA), the members of Young Academy of Japan work together with young scientists from India.

Those multi-disciplinary or trans-disciplinary academic collaboration works certainly cultivate reliable partnership and enhance building multi-tire networking within scientific community.

I am sure that this special symposium is one of the concrete examples for providing the best forum for scientists in the both countries; India and Japan, to directly collaborate together toward betterment of our future through science and technology. This endeavor will trigger further effective and significant collaboration between India and Japan.

Congratulation and may you have a fruitful symposium.

Takashi Onishi
President
Science Council of Japan

Dr. Yuichiro Anzai
President, Japan Society for the Promotion of Science

On behalf of the Japan Society for the Promotion of Science, I am very pleased to extend a hearty congratulations to the Indian Scientists Association in JAPAN for holding this 3rd ISAJ Symposium titled "India-Japan Symposium on Frontiers in Science & Technology: Successes and Emerging Challenges." This year marks the 60th anniversary of diplomatic relations between India and Japan, established in 1952. Over the decades since then, our countries have developed the partnership we enjoy today—one that spans a great variety of fields while strengthening mutual trust and friendship. Among them, I believe that scientific cooperation has become a major pillar of the Indo-Japan partnership, and is increasing in importance year by year. At this milestone juncture, I believe that holding this symposium is very significant, as it brings together leading researchers from both countries in a discussion of achievements forged on the leading edge of science and technology and on emerging research topics that we will need to challenge together.

JSPS is Japan's leading research funding agency. Our mission is four-fold: providing research funding to Japanese universities and other institutions; carrying out programs to foster young researchers; advancing university reform; and promoting scientific exchange with countries around the world. The Japanese government has recently been carrying out a process of administrative reform. As a result, JSPS has been categorized as an organization that works in cooperation with Japanese universities to support their education and research programs. As such a funding agency, JSPS will further develop a range of support schemes to facilitate the reform of Japanese universities, among which internationalization is a critical imperative.

JSPS has enjoyed long-standing collaboration with Indian institutions: with the Indian Science Academy since 1976 and the Department of Science and Technology since 1993. Through these partnerships, JSPS is striving to advance scientific collaboration between our two countries. We also use various other avenues, such as the JSPS Postdoctoral Fellowships for Foreign Researchers, to promote international exchange and strengthen collaboration with India, while internationalizing Japanese universities and other research institutions.

In this respect, I believe that the true internationalization of Japan's research institutions will depend on the degree to which friendly and mutually beneficial relationships are formed with researchers who come here from overseas to work with Japanese colleagues. Each session in this symposium will feature lectures by frontline researchers from both countries. I look forward to them being followed by spirited exchanges on views and information, ones in which you share new ideas and methods along with the latest achievements yielded by them—thus, building long-enduring personal and professional networks while planting and cultivating new seeds for scientific endeavor between India and Japan.

Sukekatsu Ushioda
President
National Institute for Materials Science
Tsukuba, Japan

Congratulatory Message

As President of National Institute for Materials Science (NIMS), I would like to congratulate the Indian Scientists Association in Japan (ISAJ) for its successful contributions to the collaborative scientific activities between India and Japan. I note that this year marks the sixty years of diplomatic relation between our two countries. In this time of challenges in Asia, I would like to emphasize the importance of continued close cooperation between the two democratic nations, India and Japan. I hope our relation will deepen not only in the scientific sphere but also in all areas that involve us both.

A message of congratulations
for the 60th anniversary of the India-Japan diplomatic relations

On behalf of the Chemical Society of Japan I would like to take this opportunity to express congratulations upon the 60th anniversary of the diplomatic relations between India and Japan this year. In these 60 years we both countries have been building an extremely favorable relationship involving JSPS-DST exchange program, with research, academic, and educational exchange flourishing. Considering the growing importance of India-Japan partnership in science and technology and building the future of science and technology collaboration between our two countries, the Indian Scientists Association in Japan (ISAJ) has organized "India-Japan Symposium on Frontiers in Science & Technology: Successes and Emerging Challenges" at the Indian Embassy Auditorium. Science and technology are considered to be the results of intellectual activities in which, throughout the long process of evolution, humans alone could participate. Humans alone could produce scientists. Frontiers in science and technology are crucial elements in the foundation of human civilization. No single person, no single group, no single institution can truly master any particular technology. I also congratulate the ISAJ unique initiative to provide an excellent venue for scientists to share ideas and discoveries and to encourage the Indian scientists/researchers in Japan and their Japanese counterparts. Through these efforts and great achievements of the ISAJ I hope to nurture the further positive relationship between them for the benefit of all.

Yasuhiro Iwasawa, Professor
The University of Electro-Communications
The University of Tokyo (Emeritus)
Former President of The Chemical Society of Japan
JSPS-DST Science Council, Coordinator, Surface Science Area

Indian Scientists Association in Japan (ISAJ)

Conveners' Welcome

We, on behalf of the Organizing Committee, warmly welcome you all - the guests and all the delegates to the 3rd symposium of Indian Scientists Association in Japan (ISAJ) on frontiers in Science & Technology: Successes and Emerging Challenges.

Indian Scientists Association in Japan (ISAJ) is three years old Non Profit Organization (NPO). Conceived at the end of 2008 by coming together of many Indian researchers working in Japan, it was formally inaugurated by Prof. R. Chidambaram, Principal Scientific Adviser to the Government of India in January 2009, in the presence of His Excellency the then Ambassador of India. The main aim of ISAJ is networking among Indian scientists in Japan. ISAJ has grown to six chapters in Japan covering from Hokkaido to Osaka and has been trying to promote regular seminars, free discussions and networking at all sites.

After two successful annual symposia, we are happy to welcome you to the third symposium today. Since this year marks the 60 years of diplomatic relations between India and Japan, this event is even more important for us. We will have it as a two-day event covering Life Sciences, Earth Sciences, Accelerator Related Sciences, Material Sciences and Space Technology. Each one of this will have plenary lectures, specialized talks and posters in a framework of interdisciplinary networking. We will have over 52 presenters giving 4 Keynote addresses, 12 plenary lectures, 6 invited lectures, 4 oral presentations and 31 poster presentations. We are very fortunate to have many dignitaries in the inaugural session as well the rest of the meeting. We are eager to hear from them. We believe that it is a great opportunity for networking not only amongst scientists but also for building the foundation for future scientific research collaboration to promote Science and Technology relationships between the two countries.

The symposium would not have been possible without *the* generous support *of the Embassy* of India especially, Dr. Chadaram Sivaji. Counsellor, Science & Technology. We also acknowledge the kind sponsorship from the Bank of India, FOP, New India Assurance, Sun and Sands Group, State Bank of India and Asian Allergy Asthma Foundation.

Finally, we take this opportunity to thank everyone for overwhelming support. We sincerely hope that we all will enjoy the symposium and that it will inspire India-Japan collaborations and friendships along with developing stronger ties in Science and Technology.

With best regards,

Sunil Kaul
Symposium Convener

Chairman, ISAJ

Alok Singh
Symposium Co-convener

Vice-Chairman, ISAJ

PROGRAM

DAY 1: September 20, 2012 (Thursday)		
8:00 - 9:00	**Registration**	
9:00 – 11:00	**Inaugural Session**	
9:00 - 9:05	Lighting of the Lamp	
9:05 - 9:10	Welcome Address	Sunil Kaul, Chairman, ISAJ
9:10 - 9:20	Inaugural Address	H.E. Ms. Deepa Gopalan Wadhwa The Ambassador of India to Japan
9:20 - 9:35	Special Address	Takashi Onishi President, Science Council of Japan
9:35 - 9:50	Special Address	Yuichiro Anzai President, Japan Society for the Promotion of Science
9:50 - 10:00	Address	Sukekatsu Ushioda President, National Institute for Materials Science
10:00 - 10:10	Address	Chadaram Sivaji Counsellor, Science & Technology, Embassy of India
10:10 - 10:25	Address	Govindan Parayil Vice-Rector, United Nations University “Scientific excellence, scientific temper and the rise of democratic India”
10:25 - 10:40	Keynote	Yasuhiro Iwasawa The Univ. of Electro-Communications, Tokyo "India-Japan S&T collaboration and frontiers in catalysis and surface science by synchrotron X-ray beam lines"
10:40 - 10:55	Keynote	Kiyoshi Kurokawa Chairman, Health and Global Policy Institute
10:55 - 11:00	Vote of Thanks	Kedarnath Mahapatra, General Secretary, ISAJ
11:00 - 11:05	**Group Photo**	
11:05 - 11:30	**Coffee Break**	

11:30 - 12:30	**Plenary Session 1: Life Sciences Chairs: D. Sakthi Kumar & Tetsuro Ishii**	
11:50 - 12:10	*Yoshihiro Ohmiya* AIST	Basics and application of bioluminescent system
12:10 – 12:30	*Toru Maekawa* Toyo Univ.	Nanotechnology: application to bio-medical study
12:30 - 12:40	*Srivani Veeranarayanan* Toyo Univ.	Triple targeted-dual drug silica nanoformulations for cancer therapeutics
12:40 - 12:50	*Yoshio Kato* AIST	Tools for genome editing
12:30 - 14:00	**Poster Session & Lunch**	
14:00 - 14:20	**Keynote Address**	*Toshio Yamagata* Univ. of Tokyo & JAMSTEC "Role of climate prediction in sustainable well-being"
14:20 - 15:30	**Plenary Session 2: Earth Sciences Chairs: Swadhin Behera & Toshio Saito**	
14:20 - 14:40	*Kedarnath Mahapatra* Tokai Univ.	Phytoplankton and climate change
14:40-15:00	*Lallan Prasad Gupta* JAMSTEC	Magnificent treasure from the Indian Ocean
15:00 - 15:15	*Ziqiu Xue* RITE Kyoto	Overviews of the Nagaoka Pilot CO2 Injection Project
15:15 - 15:30	*Prabir K. Patra* JAMSTEC	Methane as a greenhouse gas in the warmer world
15:30 - 16:00	**Coffee Break**	
16:00 - 18:00	**Plenary Session 3: Accelerator Related Sciences Chair: Masaharu Nomura**	
16:00 – 16:30	Introduction of KEK	Video
16:30 – 16:50	*Srihari Velaga* KEK	Indian beamline at Photon Factory - A multipurpose X-ray beamline facility
16:50 – 17:10	*Yoshihide Sakai* KEK	Particle physics at B Factory experiment
17:10 – 17:30	*Arpit Rawankar* KEK	Pulsed laser wire R&D for beam profile monitor

DAY 2: September 21, 2012 (Friday)		
10:00 - 12:00	**Plenary Session 4: Materials Sciences Chair: Koichi Tsuchiya**	
10:00 - 10:20	*Srinivasa Ranganathan* IISc, India & Tokyo Univ. of Arts	Advances in structurally complex intermetallics
10:20 - 10:40	*Atsushi Suzuki* Yokohama National Univ.	Potential applications of hydrogels in health and environment
10:40 - 11:00	*Koichi Tsuchiya* NIMS	Impact of torsion straining under high pressure on structures and properties of metallic materials
11:00 - 11:20	*Manabu Enoki* Univ. of Tokyo	Reliability of balloon-expandable coronary stents
11:20 - 11:40	*Alok Singh* NIMS	Very high strength and ductile Mg-alloys by strengthening with quasicrystal phase
11:40 - 11:45	*Fanqiang Meng* NIMS	Reduction of shear localization by high pressure torsion in Zr-Cu-Al bulk metallic glass
11:45 - 11:50	*Shanmugavel Chinnathambi* NIMS	Water soluble silicon quantum dots for delivery of nucleic acid drugs
11:50 - 11:55	*D.N. Awang Sh'ri* NIMS	Surface analyses of HPT deformed TiNi shape memory alloys
11:55 - 12:00	*Kosuke Kawaguchi* Univ. of Tokyo	Local order at Zn/Gd-Enriched stacking faults in a Mg-Zn-Gd alloy
12:00 - 13:00	**Lunch**	
13:00 - 13:30	**Keynote Address**	*Satsuki Matsumura* Japan Fisheries Research Agency "Oceanography from space: Japan's ocean color remote sensing program"
13:30 - 14:30	**Plenary Session 5: Space Technology Chairs: Satsuki Matsumura & Kedarnath Mahapatra**	
13:30 – 14:00	*Masahiro Takayanagi* JAXA	Current status and future perspective for Japan-India bilateral co-operation in the field of space experiments
14:00 – 14:30	*M. Vijaya Kumar* JAXA	Utilization of space environment: fabrication of advanced functional materials

14:30 - 15:30	Concluding Session	
	Panel Discussion	"Bridging the gaps in India-Japan scientific collaborations: the role of ISAJ"
	Moderator: Alok Singh (NIMS/ISAJ)	Panelists: C. Sivaji (Embassy of India), S. Matsumura (JFRA), A. Suzuki (Yokohama National Univ.), K. Tsuchiya (NIMS), S. Behera (JAMSTEC/ISAJ), S. Sinha (Sun & Sand Group)
	Award Ceremony	Presentation of Best Poster Presentation Awards supported by Asian Allergy Asthma Foundation
	Concluding Remarks	H. E. Ms. Deepa Gopalan Wadhwa The Ambassador of India to Japan

K-01

India-Japan S&T Collaboration And Frontiers In Catalysis And Surface Science by Synchrotron X-Ray Beam Lines

Yasuhiro Iwasawa

Innovation Research Center for Fuel Cells / Department of Engineering Science
The University of Electro-Communications, Chofu, Tokyo 182-8585, Japan
E-mail: iwasawa@pc.uec.ac.jp

Recent tasks and problems in modern society may be summarized below.
1. Discovering and enacting policies for sustainable development on a global scale can be said to be the greatest task of modern science and technology.
2. We can not simply apply the fruits of our research and solve this problem, and we can not continue to develop present technology in the present form and solve this problem.
3. There is no guarantee that the present technology can respond to the demands of society and industry.
4. Under these conditions, what are the obligations of science and technology and how are the perceived.

To insure a safe, prosperous journey into the future, a science and engineering roadmap is needed. In August, 2011, we at the science council of Japan provided it to the government, the nation and young talents as well as scientists.

In this decade, development of carbon dioxide utilizing technology, new materials, and high efficiency vehicles will slow the rate of climate change and reduce dependence on fossil fuels, surgical robots and synthetic vaccines will improve health, improvements in computer voice recognition and translation will improve communication, and increased understanding of earthquakes and structural engineering will improve earthquake safety. In the 20s, new discoveries in particle physics could lead to greater understanding of nature and the origins of our universe and development of room temperature super conductors, high capacity media, and self-repairing materials could lead to new devices and communication technology. Improvements in robotics and sustainable agriculture, nanotechnology and fuel cells, and photocatalytic hydrogen generation could lead to an improved quality of life for the general population. Advances in chemical synthesis, reduced precious metal devices, and renewable energy sources could greatly reduce human impact on the environment and increase understanding and control of natural phenomena. And new approaches in mathematics could lead to greater understanding of the natural world. In the 30s and 40s, greater understanding of elementary particles could lead to a grand unified theory of the universe, new high-temperature super conductors, new photonics and integrated electricity generation, and advances in communication technology. Advances in robotics, transportation technology, and energy generation and utilization could lead to food self-sufficiency, new low impact vehicles, and solar energy systems. Improvements in chemical synthesis and biotechnology could lead to carbon neutral technologies, artificial photosynthesis, and freedom from reliance on precious metals. Through these efforts, humanity can head for a safe, stable, and comfortable society, in ecological harmony, with greater understanding of life and the universe. These are only a part of the Roadmap.

In Chemistry also, a dream roadmap is needed. In March, 2012, we at the Chemical Society of Japan made and provided 30 years Chemistry Dream Roadmap to the government, the nation, media and young talents as well as scientists of different areas. These issues will also be mentioned in my talk.

Science and technology are the wisdom and spirit obtained by humans alone. Science and technology are the biggest contributor to the optimization of society
The humans alone have created Scientists throughout the long process of evolution of species.

Japan-India Science Council (JSPS-DST Program) has an Indo-Japan Collaborative Research Program including Seminar, Collaborative research, Exploratory exchange, etc. in the priority areas,
(1) Molecular and Supramolecular Science,
(2) Advanced Materials, including Polymers and Nanomaterials,
(3) Modern Biology and Biotechnology,
(4) Manufacturing Science,
(5) Astronomical and Space Science,
(6) Surface and Interface Science, including Catalysis.

These priority areas will be revised to new priority areas and fields in the next fiscal year.

An achievement of India-Japan collaboration to conduct frontiers in science and technology is seen in Indian Beamline at the Photon Factory, which is based on not only the area (6) Surface and Interface Science, including Catalysis but also more generally Nanomaterials and Functional Property. The project is sponsored by Department of Science & Technology (DST), Government of India with Saha Institute of Nuclear. The beamline BL-18B at PF is leased to DST so as to set up Indian beamline (2.5 GeV 450 mA, 36 nmrad, top-up operation). DST sets up X-ray diffractometers and 2D-detectors for on structure analysis of nano-materials, solid and liquid surfaces or thin films etc. The beamline is now open for carring out experiments by intended Indian users.

We have great expectations for India-Japan exchange, collaboration and cooperation in Science and Technology in a prosperous society and our future life.

K-02

Role Of Climate Prediction In Sustainable Well-Being

Toshio Yamagata

Application Laboratory, JAMSTEC, Yokohama

The state of human health, food production, water security, sustainable energy and the state of the earth environment are highly dependent on nature of our habitable planet. Those are extremely vulnerable to risks due to climate variations under the stress of the global change. Therefore, understanding and predicting climate variations are vital for the sustainable well-being of the human society.

Initiatives aimed at predicting climate variations have been progressing rapidly in the professional climate research community. We have reached a level at which the occurrence of El Niño can be predicted by use of a global ocean-atmosphere-land coupled model one or two years in advance. However, further research and development are necessary for predicting abnormal weather events and climate extremes that generate disasters either regionally or locally. The precarious Indian summer monsoon rainfall of this year is an example of an extreme in climate variations. Climate variations refer to the situation in which, due to various internal factors of the ocean-atmosphere coupled system, climate fluctuates significantly around the normal state from seasons to decades. This is much different from the climate change in which the normal climate state changes gradually due to external factors such as anthropogenic effects and solar insolation changes over periods longer than centuries.

The monsoon rains in India are associated with several oceanic, atmospheric and terrestrial processes related to climate variations. The Indian Ocean Dipole Mode phenomenon is one of major synthetic phenomena of such processes and, once started, it suppresses (enhances) the normal rain in the Indonesian region and enhances (suppresses) it in the Indian sub-continent during its positive (negative) phase. In the beginning of this year, our state-of-the-art coupled GCM SINTEX-F predicted a negative IOD and drier Indian monsoon season, which actually has happened for the first half of the monsoon season. But, in a rare turnaround, the negative IOD was terminated and was replaced by positive IOD much to the relief of the Indian agribusiness.

Climate applications based on a good climate prediction system will make a direct contribution to socio□economic activities of a region of interest. In one of our research initiatives supported by Japan Science and Technology Agency (JST) and Japan International Cooperation Agency (JICA), we are developing such a system for applications for the southern African region. Since production systems in southern Africa are highly dependent on nature, they are extremely vulnerable to risks due to climate variations. This project aims to clarify predictability as well as generation mechanism of climate modes such as the Subtropical Dipole Mode influencing the climate in the southern African region, and thus to contribute to sustainable well-being of the regional society by delivering better climate information. I believe that these efforts supported by *in situ* validation studies will not only contribute to deeper understanding of our habitable planet but also help us develop a resilient society under its unprecedented evolution.

K-03

Oceanography From Space: Japan's Ocean Color Remote Sensing Program

Satsuki Matsumura

Former Director of Oceanography,
National Research Institute of Far Seas Fisheries, Japan
&
Fellow, Japan Fisheries Research Agency
E-mail: satsuki_tomiko@hotmail.com

With the advancement in applications of space technology, satellite remote sensing has become an important tool for marine research as well as for marine environment observation and monitoring. Over last 25 years Japan has exerted great effort to apply satellite data for both ocean research and operational purposes especially in the fisheries sector. The first Japanese Marine Observation Satellite, Momo-1 (MOS-1) was launched on 1987 equipped with visible and thermal infrared sensors which were similar to the Advanced Very High Resolution Radiometer (AVHRR) on American NOAA series of satellite and the Multispectral Scanner (MSS) on NASA's LANDSAT series of satellites. However, there was lack of interest on the part of Japanese oceanographic research community towards ocean remote sensing data. They were apprehensive about usefulness of the sensor with such wide wavelength band (100nm) in detection of marine biological phenomena. Only some fisheries scientists tried to use those data for ocean water mass analysis related to formation of fishing ground around Japan. MOS-1 data were adequate to define and map the coastal and oceanic water masses. Coastal fishing grounds are sometimes formed along the front of those water masses. This experience prompted National Space Development Agency (NASDA) to organize Japanese ocean color research group to discuss with the ocean research community before launching the next ocean color sensor, OCTS (Ocean Color and Temperature Scanner) onboard ADEOS-1 (Advanced Earth Observing Satellite), followed by Global Imager (GLI) onboard ADEOS-II. During this period international collaboration between NASA's Earth Observing System (EOS) and NASDA was launched for global ocean monitoring. The international research community planned and undertook continued ocean color observation by the OCTS, the Sea-viewing Wide Field-of-view Sensor (SeaWiFS) and the Moderate Resolution Imaging Spectroradiometer (MODIS). Next Japanese ocean color satellite will be the Global Change Observation Mission (GCOM-C). The GCOM-C1 satellite will be equipped with the Second-generation Global Imager (SGLI) to observe the Earth's atmosphere and surface in order to contribute to the understanding of the carbon cycle, radiation budget and marine fisheries productivity.

PLENARY SESSION

ABSTRACTS

Date: -----

2012

PL-01

Basic And Application of Bioluminescent System

Yoshihiro Ohmiya

Biomedical Research Institute
National Institute of Advanced Industrial Science & Technology (AIST)
E-mail: y-ohmiya@aist.go.jp

In the entire world, there are many kinds of bioluminescent livings; firefly, railroad-worm, jellyfish, and ostracod. In general, bioluminescence is a simple reaction that is triggered by the addition of luciferin solution. Luciferin is oxidized by oxygen, converted to excited oxyluciferin and finally emits a light catalyzed by luciferase enzyme. But the structures for luciferin and luciferases show the diversity, that is, different luciferin catalyzed by corresponded luciferases resulted in the production of different color lights. All applications of bioluminescence systems are based on the principle of the chemical reaction; that is, the light intensity as the measurable product depends on the amounts of luciferase, luciferin, and cofactor(s). Luciferase assay as a reporter enzyme are used widely in promoter analysis. In general, the luciferase gene containing the target promoter region of interest in the plasmid is transfected into target cells, and 1–2 days later, the amount of luciferase protein expressed can be estimated from the light intensity. So, luciferases are suitable reporter enzymes for the quantitative measurement of gene expression. In this section, I introduce our creating system using multiple bioluminescence assays. The multicolored reporter assay using beetle luciferases that emit various colors with a luciferin can observe the dynamics of three gene expressions in the cells. Namely, our tricolor reporter in vitro assay system in which three gene expressions are monitored simultaneously using green-, orange- and red-emitting beetle luciferases for gene expression analysis. The multicolored reporter cell line reveals the expressions change of two or three genes under the target chemicals or products simultaneously. Our technique is a unique and a powerful tool for the drug screening or toxicity test.

PL-02

Nanotechnology: Application To Bio-Medical Study

Toru Maekawa

Bio-Nano Electronics Research Centre
Toyo University
Kawagoe, Saitama, Japan
E-mail: maekawa@toyo.jp

My talk focuses on three topics; that is, (a) the creation of nanomaterials at low temperature via self-assembly; (b) the secondary structures formed by magnetic nanomaterials; and (c) the application of nanomaterials to bio-medical studies.

(a) Creation of nanomaterials at low temperature via self-assembly: The gas-liquid coexistence curves terminate at the critical points, where large molecular clusters are formed and as a result, the physical properties such as the specific heat and compressibility diverge and incident light cannot penetrate the fluid; known as critical opalescence. The critical temperatures are generally low; e.g., 31.0 °C (carbon dioxide), 32.2 °C (ethane), 16.6 °C (xenon) and 289.0 °C (benzene). A variety of nanostructures such as carbon onions, coils and fibres are self-assembled in fluids near their critical points.

(b) Secondary structures formed by magnetic nanomaterials: Clusters are formed via magnetic dipole-dipole interactions. The effect of dc, ac and rotational magnetic fields on the creation of chains, rings and other complex structures are investigated and discussed.

(c) Application of nanomaterials to bio-medical studies: The application of the nanomaterials; e.g., fullerenes, carbon nanotubes and magnetic nanoparticles, to bio-medical studies such as the detection of diseases, targeting and separation of specific molecules or cells and bio-imaging is explained.

PL-03

Phytoplankton and Climate Change

Kedarnath Mahapatra and Yoshihiro Okada

School of Marine Science & Technology
Tokai University 3-20-1 Orido, Shimizu-ku, Shizuoka
E-mail: kedar@scc.u-tokai.ac.jp

Phytoplankton are too small to be seen with the naked eye. They obtain energy through a process called photosynthesis, and so must live in the well-lit surface layer of the ocean. Through photosynthesis, phytoplankton are responsible for much of the oxygen present in the Earth's atmosphere. Their cumulative energy fixation in carbon compounds (primary production) is the basis for the vast majority of oceanic food chains, providing food for little sea animals called zooplankton, which in turn feed fish and other creatures. Any change in phytoplankton numbers alters the ocean food chain. Climate change is influencing both open ocean and coastal marine ecosystems. In the open ocean, change of stratification and other forcing may alter phytoplankton biomass and composition and resulting change of primary production and carbon export to deep ocean. In the coastal ocean, change of river discharge may also change primary production. Climatologically anomalous events such as El Niño/La Niña and Indian Ocean Dipole Mode (IODM) trigger dramatic changes in phytoplankton concentration that not only affect the food chain, but also influence Earth's climate. Furthermore, extreme events associated with climate change, such as typhoon, affect to both ocean and coastal marine ecosystems. Those may influences global carbon cycle and make positive or negative feed back to the global climate. Observation of phytoplankton concentration (ocean color) by satellite borne sensors, have been playing an important role in the study of interaction between climate change and marine ecosystem. Following about 15 years of continual data collected by the ocean color sensors launched by different space agencies (NASA, JAXA, ESA, ISRO), our understanding about impacts of climate change on phytoplankton abundance and other ocean ecosystem related processes has considerably increased in the recent years. Through this talk I will present an overview of the status and deal with some promising aspects of the recent results in addressing climate change related issues.

PL-04

Magnificent Treasure From The Indian Ocean

Lallan Prasad Gupta

Kochi Institute for Core Sample Research, JAMSTEC
200 Monobe otsu, Nankoku 783-8502, Japan
E-mail: gupta@jamstec.go.jp

Scientific ocean drilling started about 4 decades ago, and a result of that large amount of drilled material (core sample) has been collected from various seas and oceans, including Indian Ocean, under the auspices of the Integrated Ocean Drilling Program (IODP) and its predecessor ODP and DSDP (Ocean Drilling Program and Deep Sea Drilling Program). The samples are being curated in 3 IODP core repositories around the world. The Kochi Core Center (KCC) is one such core repository jointly managed by the Kochi University and Japan Agency for Marine-Earth Science and Technology (JAMSTEC). The Center has large reefers for storing core samples and state-of-the-art instruments for high precision analyses of the same. Besides curating cores collected by the university and JAMSTEC, KCC curates about 93 km of core material collected under the IODP/ODP/DSDP from the Indian Ocean and western Pacific Ocean. The core samples are made available to the science community, educators and museums for research and education purpose. Sample requests are received through the website www.iodp.org, and after evaluation of the request by curator, samples are provided at no cost. The magnificent treasure of the samples is utilized by scientists all over the world for research dealing with various aspects of the past environmental changes, sub-seafloor structural geology, mechanism of earthquakes, and sub-seafloor biosphere. Besides the usual core samples, an archive of deep-frozen core samples (Deep Biosphere Sample or DeBIOS) is also being maintained for promoting research about sub-seafloor biosphere. In addition, X-CT based 3-dimensional images of the cores are being made available through a Virtual Core Library for structural geology and physical property related research. The treasure can be utilized not only for creating new scientific knowledge but also for generating important data and background information in support of new drilling proposals.

PL-05

Indian Beamline At Photon Factory – A Multipurpose X-Ray Beamline Facility

Srihari Velaga

Surface Physics Division, Saha Institute of Nuclear Physics,
Sector-1, Block-AF, Bidhannagar,
Kolkata, 700 064, INDIA
E-mail: vsrihari_kjgm@yahoo.co.in

The Indian beamline (18B) at Photon factory, Japan (setup by SINP) is offering X-ray scattering experiments for various sample types and environments. The beamline is equipped with a four circle and an eight circle goniometers for various scattering experiments on powder, thin films, single crystal and liquid-liquid and liquid-solid interfaces. This facility caters needs of Indian scientist in X-ray scattering analysis of powder, thin films samples. The measurements can be performed in various temperature ranges, for this we have equipped with a Close Cycle Refrigerator (CCR) for low temperature measurements and a heat cell for high temperature measurements. We can do low temperature measurements from room temperature down to 10 K with CCR, with an accuracy of ±0.1 K. The high temperature setup is of Anton Paar DHS 1100 high temperature cell which can be operated from room temperature to 1100 °C with an accuracy of ±0.5 °C, under various protective gas environments. Apart from the above facilities we are equipped with a high pressure X-ray diffraction of powder samples with Diamond Anvil Cell (DAC) ≤ 30 Gpa with onsite sample loading facility. Other than the regular diffraction measurements these high temperature and low temperature facilities can be used for X-ray reflectivity (XRR) from thin films and malty layers. The beamline is equipped with a point detector for high resolution powder diffraction experiments, an image plate and a 100K Pilatus 2d detector for fast data acquisition. Apart from the above measurements the beamline facilitates the liquid spectrometer for scattering experiments from the liquid-liquid and solid-liquid interfaces and in soft mater (one of the unique facilities).

In this presentation we will present some of the recent results of diffraction measurements from the beamline along with brief details on how to apply for the beam time for desired experiments and statistics of previous beamline usage.

PL-06

Particle Physics at B Factory Experiment

Yoshihide Sakai

Institute of Particle and Nuclear Studies,
High Energy Accelerator Research Organization (KEK)
1-1 Oho, Tsukuba, Ibaraki 305-0801, JAPAN
E-mail: yoshihide.sakai@kek.jp

The Belle experiment is a particle physics experiment with an international collaboration at B-Factory accelerator, KEKB, at High Energy Accelerator Research Organization (KEK). The collaboration consists of about 400 physicists from 60 institutes in 15 countries, including 5 institutes from India. The KEKB is an asymmetric-energy collider with 8 GeV electron and 3.5 GeV positron beams. The KEKB achieved the world highest luminosity of 2.1 x 10^{34} $cm^{-2}sec^{-1}$ and produces huge amount of various elementary particles including B mesons, which are used in a main research. Thanks to success of the accelerator and large accumulated data sample, the experiment produced various important results. It discovered CP violation in B-meson system in 2001 and verified the Kobayashi-Maskawa theory with further measurements of CP violation phenomena, which lead to the Nobel Physics Prize to Profs. Kobayashi and Maskawa in 2008.

The operation of the KEKB/Belle finished in June 2010 and now the upgrade project of the accelerator (SuperKEKB) and experiment (Belle II) is in progress, where 40 times higher peak luminosity and accumulation of 50 times larger data sample are aimed. We expect to discover a new source of CP violation and new phenomena to understand a new physics theory, which is beyond the current Standard Model.

Indian group has been making significant contributions in the operation of the experiment and physics analyses. Also, the group has been working on R&D, design, and construction of the upgraded detector.

PL-07

Pulsed Laser Wire R&D For Beam Profile Monitor

Arpit Rawankar[1,2#], Junji Urakawa[1,2], Hirotaka Shimizu[2], Yan You[3],
Nobuhiro Terunuma[1,2] and Yosuke Honda[2]

[1]*Department of Accelerator Science, School of High Energy Accelerator Science*

Graduate University for Advanced Studies, Shonan International Village

Hayama, Miura, Kanagawa 240-0193, Japan

[2]*High Energy Accelerator Research Organization [KEK]*

1-1 Oho, Tsukuba, Ibaraki 305-0801, Japan,

[3]*Department of Engineering Physics, Tsinghua University, Beijing, 100084, China*

E-mail: arpit@post.kek.jp

Laser-Compton scattering has become an important technique for beam diagnostics of the latest accelerators. In order to develop technologies for low emittance beam, an Accelerator Test facility (ATF) was built at KEK. It consists of an electron linac, a damping ring in which beam emittance is reduced and an extraction line. For emittance measurement we are developing a new type of beam profile monitor, which works on the principle of Compton scattering between electron and laser light. In order to achieve effective collision of photon and electron, very thin size laser is required. Such type of optical resonator system is called laser wire. Laser wire is one of such a technique to measure a small beam size. Using a pulsed compact laser wire, we can measure 5 μm electron beam in vertical direction. Four mirror resonator reduces the sensitivity to the misalignment of mirror comparing with two mirror resonator. To make a compact resonator with very small beam waist less than 5 μm the aspect ratio is important. Total cavity length of four mirror resonator is matched according to pulse repetition of mode locked laser oscillator. Electron beam inside damping ring has repetition rate of 357 MHz and pulsed repetition rate of mode-locked IR laser oscillator is 714 MHz. Minimum beam waist is obtained in sagittal plane using IR pulsed laser. Advantage of such type of compact four mirror resonator is total scanning time for measurement of electron beam profile which is much shorter as compare to CW laser wire system. With green laser which is converted to second harmonics from IR pulsed laser, minimum beam waist is half of beam waist obtained using IR laser oscillator. Therefore, it is possible to obtain beam waist less than 5 μm (σvalue) using green laser pulse, which is required for effective photon-electron collision. We report the development and performance studies of such type of compact four mirror laser wire system.

PL-08

Advances In Structurally Complex Intermetallics

Srinivasa Ranganathan[1,2]

[1]*Indian Institute of Science, Bangalore, India*
[2]*Tokyo University of the Arts, Tokyo, Japan*
E-mail: rangu2001@yahoo.com

The advent of the intermetallic, nickel aluminide, made possible the revolution in aviation by allowing jet engine turbine blades to operate at increasingly higher temperatures. Similarly, the titanium aluminides promise to improve the performance in auto engines. These represent structurally simple intermetallics with a few atoms per unit cell and are based on the classical metallic structures of face centered cubic, hexagonal close packed and body centered cubic structures. In the past few decades Structurally Complex Intermetallics (SCI) have begun to attract intense attention. We give the current status of these novel materials.

Delta bronze, an alloy of Copper and Tin, has been known for millennia in Asia including India and Japan for making metallic mirrors. It is actually an SCI with local icosahedral clusters. Next we will describe several intermtallics with giant unit cells with thousands of atoms per unit cell. This leads us to quasicrystals with no unit cell! These are also SCI and the 2011 Nobel Prize was awarded to Danny Shechtman for their discovery. The possibility that an old meteorite, perhaps as old as the earth, is a quasicrystal, has sparked interest. It is an intriguing fact that many alloys which give rise to bulk metallic glasses can also be described as SCI, even though they possess no crystal structure.

While the complex structures are scientifically fascinating, their applications are still seen to be limited to niche areas. They warrant further investigations by Indian and Japanese investigators who have earlier made seminal contributions to the areas covered in this lecture.

PL-09

Potential Applications Of Hydrogels In Health And Environment

Atsushi Suzuki

Department of Materials Science & Research Institute of Environment & Information Sciences, Yokohama National University, 79-7 Tokiwadai, Yokohama, 240-8501 Japan

E-mail: asuzuki@ynu.ac.jp

A polymer gel is a soft, condensed material of a random two-phase system consisting of a polymer (solid) and a solvent (liquid). It is well known that such systems have solid-like and liquid-like behaviors due to their elastic and osmotic nature, which is determined by external physical and chemical conditions. There are typically two forms of crosslinking that produce either a chemically or a physically crosslinked hydrogel. In chemical hydrogels polymer chains are connected by covalent bonds, while by non-covalent bonds in physical hydrogels. Chemical gels are known to have unique properties, particularly with respect to volume phase transition and critical behavior. On the other hand, physical gels show the elution and erosion phenomena, where molecular chains in gels are partially released from the gel in response to external stimuli. Due to these characteristic properties of hydrogels, a wide range of applications has been proposed in the fields of foods, agriculture, functional membranes, soft actuators, and medical engineering.

Among a variety of hydrogels, poly(vinyl alcohol) (PVA) gels or films have been used for practical applications in a variety of fields. PVA gels are useful biomaterials due to their low toxicity and high biocompatibility, and many studies on their practical applications have been reported by researchers in a variety of fields. The physically crosslinked PVA gel has several advantages; it can be returned to polymer aqueous solution only by heating, and can be recycled many times after usage. In fact, physical PVA gels prepared using a freeze-thawing method have been extensively studied to improve their mechanical strength.

Recently, a simple method to obtain a physically crosslinked PVA gel (PVA cast gel) was successfully developed. The materials used in this technique were water and PVA powders (no special chemicals were used), and the gelation proceeded during the drying process after casting the PVA solution into a mold. The formation of microcrystallites was identified during the drying process (gelation process) using an X-ray diffraction (XRD) technique, a Fourier transform infrared (FT-IR) spectroscopy, and measurements of the swelling ratio under repeated water exchanges. The dried sample could swell and was insoluble in water even after sufficient water exchange, which indicated that PVA cast gel was a physically crosslinked polymer network, in other words, a swollen hydrogel, cross-linked by microcrystallites. This technique is simple, safe and cheap, therefore it is possible to minimize energy and water consumption.

On the basis of the recent fundamental studies on the PVA cast gels, it was shown that the gel has different functional performances compared with the conventional hydrogels prepared by a repeated freeze-thawing method. PVA cast gel is transparent and elastic, while the conventional gel is opaque and inelastic, although the network structures in the nanometer level are basically same. These unique characteristics make PVA cast gel various kinds of applications in health and environment, such as biomaterials as artificial cartilages, medical and pharmaceutical materials, hydroponic culture media, and other environment

conscious products. To extend the range of applications of PVA cast gel, it is desirable to improve the water absorbency and the mechanical strength for the practical uses under various operating conditions. The most promising method to improve the performance intrinsically is to control the size, number, and the distribution of microcrystallites in multiple scales from nanoscopic to submicron order. Incorporation of functional molecules and lamination by making multilayered gels are also effective tools to improve the mechanical performance extrinsically.

In this lecture, the methods to improve the functional performance of PVA cast gels will be presented, and the advantages and disadvantages of the gels to apply in the fields of health and environment will be discussed on the basis of the present results.

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PL-10

Impact of Torsion Straining Under High Pressure on Structures And Properties of Metallic Materials

Koichi Tsuchiya

Microstructure Design Group, Structural Materials Unit,
National Institute for Materials Science,
1-2-1 Sengen, Tsukuba 305-0047
E-mail: TSUCHIYA.Koichi@nims.go.jp

High pressure torsion (HPT) is one of the shape-invariant severe plastic deformation method and is capable of extensively straining brittle materials. This talk focuses on the formation of nanostructures by HPT in various intermetallic compounds and metallic glass.

Ni_3Al intermetallic compound is an important strengthening phase in Ni-base superalloys. It is well known that the material is very brittle in polycrystalline form due to grain boundary brittleness. We have applied high-pressure torsion (HPT) on polycrystalline Ni_3Al at room temperature. HPT deformed samples composed of disordered and equiaxed grains of about 50 nm and plate-like coarse subgrains separated by thin (~10 nm) twin plates. Increasing number of rotation (N) lead to an increase in the volume fraction of the nanograin. Formation of such heterogeneous structure drastically increased total tensile elongation to 5 % with tensile strength exceeding 2 GPa after HPT deformation of $N = 1$.

Transition of deformation mode from heterogeneous, localized deformation to homogeneous flow was observed in $Zr_{50}Cu_{40}Al_{10}$ bulk metallic glass (BMG) by HPT deformation of $N = 50$. The transition is accompanied by a pronounced decrease in hardness (from 6.1 GPa to 4.9 GPa) and elastic modulus (from 104 GPa to 76 GPa) measured by nanoindentation. Annealing of the deformed BMG resulted in the restoration of localized deformation, hardness and elastic modulus; thus the transition is reversible. The observed reversible transition can be attributed to the change in the local atomic environment in the rejuvenated volume after HPT and the relaxed state after annealing.

PL-11

Reliability of Balloon-expandable Coronary Stents

Manabu Enoki

Department of Materials Engineering, School of Engineering
The University of Tokyo
E-mail: enoki@rme.mm.t.u-tokyo.ac.jp

A plenty of stent fractures after implantation have been reported. Although failures occur rarely and most of them do not threaten the life of patient, they still should be avoided as much as possible. For the long-term service, mechanical loadings both in circumferential and longitudinal directions should be taken into consideration. In this study, uniaxial fatigue tests were carried out on commercially available balloon-expanding stents to study the mechanical performance and obtain some guideline for preventing stent fractures.

Several types of commercially available stents with different materials or structures were prepared. Four of them were bare metal stents while one was drug-eluting stents. Group A and B had the same geometric structures using cobalt alloy MP35N and stainless steel 316L, respectively. Each cell of the stent included 10 crowns, and 2 of them were laser-welded to link with the neighbor cell. Group C, D and E were of comparatively different structures but with the same manufacture method (slotted tube). Group C stents were made from Cobalt alloy L-605; Group D and E were made from 316L stainless steel. In this study, fatigue tests were taken out on the electromagnetic force micro material tester. Frequencies were set to be 10Hz for accelerated tests, maximum strain amplitude was 40%, and strain ratio was -1 which described a severe condition as both tension and compression were engaged. The effect of both materials and structures was further studied using finite element method (FEM).

Strain-number of cycles (S-N) curve was more significantly affected by geometric structures than materials of stents. Under such uniaxial condition (R= -1, 0.1), modular structures had better perform than slotted tube stents. Meanwhile, MP35N stents had a longer endurance than 316L ones. Fatigue cracks initiated from both center and surface of struts which was quite different from common bulk materials. Limited over-expansion had little effect on S-N curves. Combined stress analysis by FEM show a reasonable result which was nearly in accordance with reported stress controlled fatigue data.

PL-12

Very High Strength And Ductile Mg-Alloys by Use of Quasicrystalline Phase For Strengthening

Alok Singh

Structural Materials Unit, National Institute for Materials Science (NIMS)
1-2-1 Sengen, Tsukuba 305-0047, Japan
E-mail: Alok.singh@nims.go.jp

A remarkable discovery was made about 30 years ago of an ordered phase which is not periodic but quasiperiodic, i.e., quasiperiodic crystals or quasicrystals. This discovery was awarded with Nobel Prize last year. With its unusual structure, this phase also showed unusual properties. One possible use was as a strengthening phase in alloys, but could not be realized in aluminum alloys due to complexity of phase equilibrium.

Stable quasicrystals were also then discovered in Mg-Zn-RE (RE= yttrium or rare earth elements). Remarkably, in these alloys the quasicrystal phase exists in direct equilibrium with α-Mg phase, so that a two-phase structure can be formed with varying amounts of quasicrystal phase. Our studies also showed that the quasicrystal phase can form 'coherent' interfaces with crystals, including the Mg-matrix. This is different from periodic intermetallic phases in which not all facets are epitaxial with the matrix.

With the threat of global warming looming large, it is important to control green house gas emissions, which mean making automobiles more fuel efficient. To achieve this, weight reduction of automobiles is a must. Magnesium being the lightest of the structural metals, its growing use in automobiles is inevitable, but challenges remain in making it stronger and more ductile.

Quasicrystals phase has been used to strengthen magnesium alloys to show that very high strengths accompanied by ductility is possible. By fine dispersion of the quasicrystal phase, and a very fine grain size of ~1μm, mechanical properties with yield strength about 400MPa (in tension as well as in compression), accompanied by elongations (ductility) of 12-16% can be obtained by simple processing. The microstructures are stable over time. Thus due to the strong interfaces with the matrix, the quasicrystal phase can impart strengthening without degradation of ductility, unlike crystalline intermetallic phases.

IL-01

Triple Targeted-Dual Drug Silica Nanoformulations For Theragnostics of Cancer And Its Associated Angiogenesis

Srivani Veeranarayanan*, Aby Cheruvathoor Poulose, Sheikh Mohamed, Saino Hanna Varghese, Yutaka Nagaoka, Yasuhiko Yoshida, Toru Maekawa and D. Sakthi Kumar

Bio-Nano Electronics Research Centre, Graduate School of Interdisciplinary New Science, Toyo University, 2100, Kujirai, Kawagoe, Saitama 350-8585, Japan
E-mail: sriuvv@gmail.com

Engineering high-precision nanoscale therapeutic agents remains an elusive and fundamental challenge to date in the combat against cancer and various ailments. Although the biocompatibility and targeting efficacy of silica nanoparticles are promising, addressing the patho-targeting of cancer has not been elucidated yet, owing to the versatility of pathological features in cancer.

The present study was formulated to investigate the targeting efficacy of dye and dual drug load silica nanoparticles, functionalized with triple targeting ligands specifically directed towards cancer and neo-angiogenesis simultaneously. This synergized multi-target conception culminated into an elevated uptake of nanoparticles by cancer cum angiogenic cells with amplified proficiency, which could be visually monitored by the accompanying fluorescent dye. The dual-drug consignment of the targeted silica nanoparticles acts on pathological cells, imparting cumulative cytotoxicity by specialized modes of action, distinct to individual drug entity.

The high precision targeting achieved with the nanoparticles is aptly complemented by the negligible toxicity rendered to normal cells. In addition, migration and angiogenic sprouting ability of activated endothelial cells were completely disabled by this nanoformulation.

The results acquired clearly present a promising and reliable option for therapeutics germane to malignancy and the related angiogenic events simultaneously leading to suppression of tumor growth.

IL-02

Tools for Genome Editing

Yoshio Kato

National Institute of Advanced Industrial Science & Technology (AIST)
Central 4, 1-1-1 Higashi, Tsukuba, Ibaraki 305-8562, Japan
E-mail: y-kato@aist.go.jp

With the great advance of DNA sequencing technology, we have been accumulating the knowledge on the genome, which is entirety of an organism's hereditary information. The manipulation of the genome is the long-awaited technology in biology, however, accurate recognition of the tiny array of DNA sequence among billions of base-pairs prevented us from the genome editing.

Recently, Zinc-finger nucleases (ZFNs) have emerged as the versatile reagents for genome engineering. ZFNs are hybrid enzymes composed of a programmable DNA-binding domain and a DNA cleaving domain. This technology has enabled highly efficient gene disruption in numerous organisms and has facilitated the progress of targeted gene therapy in humans, although gene therapy with ZFNs requires a viral gene delivery system. To overcome this problem, we delivered ZFN into human cells as a form of protein to knock-out the targeted gene. Our findings suggest that protein delivery of ZFNs can be the promising technology for genome editing and cell therapy.

IL-03

Overviews of The Nagaoka Pilot Co_2 Injection Project --Storing Co_2 In Saline Aquifers--

Ziqiu Xue

Chief Researcher, CO_2 Storage Group
Research Institute of Innovative Technology for the Earth

A number of pilot and commercial CO_2 storage projects are underway or proposed. Several key questions need to be answered when the CO_2 storage is to be undertaken worldwide. Such as how is CO_2 stored underground? What happens to the CO_2 when it is injected? What are the physico-chemical and chemical processes involved? Injection of CO_2 into the pore space and fractures of a permeable formation can displace the in situ fluid or the CO_2 may dissolve in or mix with the fluid or react with the mineral grains or there may be some combination of these processes. In comparison to the offshore location of the Sleipner Project, the Japanese Nagaoka project looks at the geophysical monitoring of CO_2 injection in an onshore saline aquifer. The CO_2 was injected into a thin permeable zone of the reservoir at 20-40 tonnes per day. The CO_2 injection started on July 2003 and ended on January 2005. The total amount of injected CO_2 is about 10,400 tonnes. In this paper, we present the results of geophysical and geochemical observations at the Nagaoka site. We collected formation water and rock samples from the reservoir, and conducted laboratory experiments to investigate the seismic wave response and geochemical reactions due to the CO_2 injection under simulated in situ conditions. The results of geochemical reactions demonstrated the potential of reservoir sandstones at the Nagaoka site for the effective solubility, ionic, and mineral trapping of CO_2. This paper presents the results obtained from both field and laboratory to examine these processes and their influence on geological storage of CO_2 at the Nagaoka site.

IL-04

Methane As A Greenhouse Gas In The Warmer World

Prabir K. Patra[1,2], Arindom Ghosh[1,3,*], Kentaro Ishijima[1], Shinji Morimoto[3], Shuji Aoki[2] and Takakiyo Nakazawa[2,1]

[1]Research Institute for Global Change/JAMSTEC, Yokohama 236 0001
[2]Center for Atmospheric and Oceanic Studies, Tohoku University, Sendai 980-8578
[3]Arctic GRENE center for excellence, National Institute for Polar Research, Tokyo 190-8518

Methane (CH_4) is the second most important longlived greenhouse gas, after carbon dioxide (CO_2), whose global warming potential is about 23 times greater than CO_2 on per molecule basis over one 100 years time horizon. Methane also contributes to formation of tropospheric ozone (O_3), which is an air pollutant and causes reduction in crop production. Our research in RIGC/JAMSTEC focuses on understanding the CH_4 life cycle using the CCSR/NIES/FRCGC Atmospheric General Circulation Model (AGCM) based Chemistry Transport Model (ACTM). In the life cycle analysis, we estimate different components of CH_4 emissions at the Earth's surface and loss in the atmosphere with the help of ACTM numerical simulations and a variety of measurements in the atmosphere. Our results suggest the water inundated surfaces (wetlands, lakes, rice fields) and burning of forest/peatland/savannas are the main cause of year-to-year variations in CH_4 due to the natural climate variability, such as the El Nino Southern Oscillation (ENSO). While the human activities have led to an increase in atmospheric CH_4 concentration from about 800 ppb (parts per billion) in 1900 to about 1800 ppb in 2010. We also show that reduction in CH_4 emissions is much more effective compared to CO_2 emissions from fossil fuel consumption from most of the South Asian countries.

IL-05

Current Status And Future Perspective For Japan-India Bilateral Co-operation In The Field of Space Experiments

Masahiro Takayanagi

ISS Science Project Office, Institute of Space and Astronautical Science (ISAS),
Japan Aerospace Exploration Agency (JAXA)
2-1-1 Sengen, Tsukuba, Ibaraki 305-8505, Japan
E-mail: natsuisaka.makoto@jaxa.jp

Japan started to launch a series of modules consisting of Japanese experiment module, "KIBO"(*), to attach those to International Space Station (ISS) in 2008 and completed its assembly in 2009. Since then Japan has carried out various space experiments covering physical, life, medical and space sciences with its versatile capabilities. Those experiments and sciences have tried to reveal the effects of space environments (microgravity, space radiation, high vacuum, wider views) on each research target and sometime use and/or used other research opportunities like recovery satellites, space shuttles, sounding rockets, parabolic flights, drop towers as well as ISS.
Also, India launched the first recovery satellite, "Space Capsule Recovery Experiment (SRE) -I", to acquire basic knowledge and technologies for aviation, maneuvering, navigation, thermodynamics, and thermal protection of recovery satellites in 2007 and performed some material processing during the mission.

Through exchange information of those activities on academic and space agency levels, Japan Aerospace Exploration Agency (JAXA; Japanese space agency) and Indian Space Research Organization (ISRO; Indian space agency) agreed to perform a joint life science experiment with the second Indian recovery satellite, "SRE-II".

The presentation will summarize those activities and introduce other efforts and frameworks to endorse bilateral collaborations between Japan and India in the field of space experiments.

IL-06

Utilization of Space Environment: Fabrication of Advanced Functional Materials

Malahalli Vijaya Kumar and Takehiko Ishikawa

Institute of Space and Astronautical Science (ISAS), Japan Aerospace Exploration Agency (JAXA), Tsukuba, Ibaraki 305-8505, Japan
E-mail: vijay.savi@gmail.com

Materials science in Microgravity condition is one of newly established cutting edge science field. After the effort of space development and space utilization, microgravity of space environment has been considered as one of novel tools for materials science because it assures containerless levitation. Besides materials processing experiments under microgravity condition in space, material scientists made lots of effort for materials processing studies using a "*microgravity simulation laboratory"* on earth. Among these, containerless processing by levitation technique has been extensively used for material science and engineering because it suppresses inhomogeneous nucleation from the container wall and helps to produce stable, metastable and glass phases. Recently, research on multiferroics, bulk glass and glass-ceramics have attracted the attention of material scientists as they are considered as low cost optical and electronic materials of the future. In the present study, the formation of multiferroic *h*-RTO_3 (R=Rare-earths and T=Transition metals), bulk spherical glass and crystalline $RAlO_3$ phases has been investigated due to their unique features in terms of the solidification process from an undercooled melt, glass structure and optical properties.

In order to undercool the melt deeply below the melting temperature under a precisely controlled oxygen partial pressure, an aerodynamic levitator (ADL) combined with ZrO_2 oxygen sensor was designed. A spherical sample with a diameter of ~2.5 mm and mass of ~20-25 mg was levitated and completely melted by a CO_2 laser in an atmosphere with predetermined Po_2. The surface temperature of the levitated droplet was monitored by a two-color pyrometer. Then, the droplet was cooled by turning off the CO_2 laser.

The x-ray diffraction results of the rapidly solidified RTO_3 and $R_3Fe_5O_{12}$ samples at various oxygen partial pressures confirm the existence of the metastable *h*-$RFeO_3$ phases. The scanning electron microscopy images of cross-sectioned samples, TG/DTA, Transmittance and Refractive Index studies were performed for both glass and crystalline phases. On the other hand, the glass transition temperature of $RAlO_3$ (Tg) gradually increased with increasing ionic radius and high refractive index of ~2.0 suggesting that containerless levitation is an elegant technique for fabrication of new glass and crystalline materials from undercooled melt.

POSTER SESSION

ABSTRACTS

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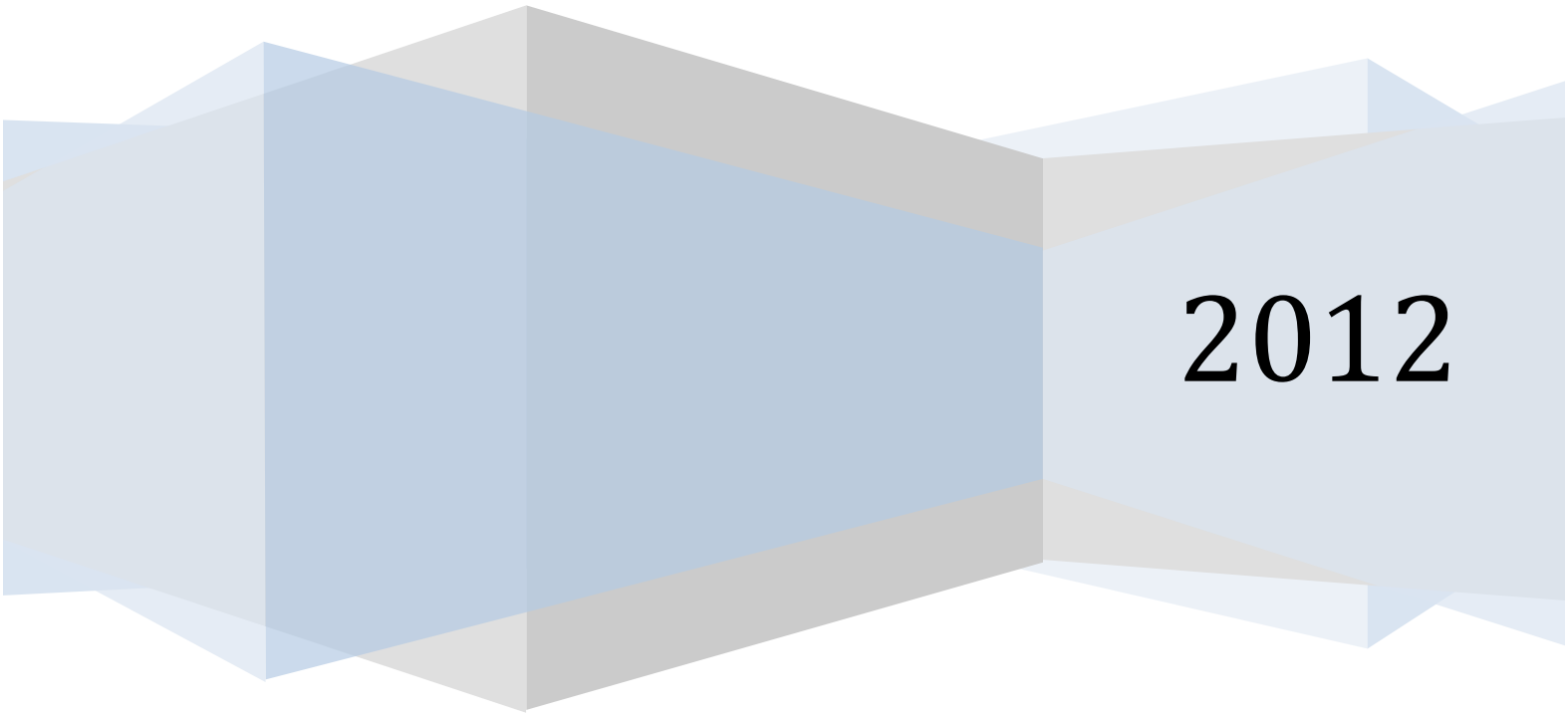

P-01

Aptamer Tagged PLGA-Lecithin-PEG Nanoparticles For Tumor Cell Targeting And Drug Delivery

Athulya Aravind, Remya Nair, Yutaka Nagaoka, Yasuhiko Yoshida,
Toru Maekawa and D. Sakthi Kumar

Bio Nano Electronics Research Center, Graduate School of Interdisciplinary New Science
Toyo University Kawagoe, Saitama, 350 - 8585, Japan
E-mail: athulya.aravind@gmail.com, sakthi@toyo.jp

Liposomes and polymers are widely used drug carriers for controlled release since they offer many advantages like increased treatment effectiveness, reduced toxicity and are of biodegradable nature. In this work, anticancer drug loaded PLGA-lecithin-PEG nanoparticles were synthesized and were functionalized with AS1411 anti-nucleolin aptamers for site specific targeting against tumor cells, which over expresses nucleolin receptors. The particles were characterized by Transmission Electron Microscope (TEM) and X-ray photoelectron spectroscopy (XPS). The drug loading efficiency, encapsulation efficiency and *in vitro* drug release studies were conducted using UV spectroscopy. Cytotoxicity studies were carried out in two different cancer cell lines, MCF-7 and GI-1 cells and two different normal cells, L929 cells and HMEC cells. Confocal microscopy and flowcytometry confirmed the cellular uptake of particles and targeted drug delivery. The morphology analysis of the nanoparticles proved that the particles were smooth and spherical in shape with a size ranging from 60nm - 110nm. Drug loading studies indicated that under the same drug loading, the aptamer targeted nanoparticles show enhanced cancer killing effect compared to the corresponding non-targeted nanoparticles. In addition, the PLGA-lecithin-PEG NPs particles exhibited high encapsulation efficiency and superior sustained drug release than the drug loaded in plain PLGA NPs. The results confirmed that AS1411 aptamer tagged PLGA-lecithin-PEG NPs are potential carrier candidates for differential targeted drug delivery.

P-02

Surface Analyses of HPT Deformed TiNi Shape Memory Alloys

D. N. Awang Sh'ri[1,2], K. Tsuchiya[1,2] , A. Yamamoto[1]

[1]National Institute for Materials Science, Tsukuba, Ibaraki, Japan
[2]University of Tsukuba, Tsukuba, Ibaraki, Japan
E-mail: AWANGSHRI.Dayangku@nims.go.jp

High pressure torsion technique in which materials are exerted with high compressive force and concurrent torsion straining allows for obtaining nanostructured materials has been shown to improve the mechanical properties of TiNi alloys. TiNi with superior shape memory and superelastic properties has been used widely in medical device applications due to its good biocompatibility. The bioinertness of the TiNi alloys has been attributed to the formation of protective passive film that forms spontaneously upon contact with air. In biological environment, this natural oxide films will acts as interface between material-cell interactions. However, the changes in TiNi structure due to HPT deformation may affect the formation behavior of this oxide film. Thus, in present study, the changes in surface chemistry of HPT deformed TiNi is investigated.

Ti-50 mol%Ni was subjected to HPT deformation for 0.25, 0.5 and 10 turns. The samples were polished until mirror finish. X-ray photoelectron spectroscopy (XPS) was carried out using Al K2 (energy=1486.71 eV). Samples were positioned at the electron takeoff angle normal to the surface with respect to the analyser. The XPS peaks for Ti2p, Ni2p, O1s and C1s were recorded and analyzed from the surface of the samples.

The formation of the passive films on the HPT deformed samples changes greatly with the number of rotation. The Ni/Ti ratio detected on the surface of the substrates decreased with the number of rotation with the ratio approaching 1, consistent with the equiatomic composition of the bulk. The decrease of the Ni/Ti ratio indicates that no Ni enriched layer was form under the oxide films in HPT samples. The thickness of passive film also decreases with the HPT rotations. The amorphization induced by HPT may change the oxidation kinetics. However, further investigation is necessary to clarify the mechanism of passive film formation on HPT deformed samples.

P-03

Influence of Sandblasted Surface Characteristics on Initial Cell Response

S. Bhargava[1,2], S. Kuroda[1], J. Hao[1,2], K. Noritake[1,2], H. Aoki[3], S. Ichinose [4], T. Hanawa[5], K. Ohya[6] and S. Kasugai[1,2]

[1]Oral Implantology & Regenerative Dental Medicine, Department of Masticatory Function Rehabilitation, Graduate School, Tokyo Medical & Dental University, Tokyo, Japan; [2]Global COE Program, Tokyo Medical & Dental University, Tokyo, Japan; [3]International Apatite Institute, Tokyo, Japan; [4]Instrumental Analysis Research Center, Tokyo Medical & Dental University, Tokyo, Japan; [5]Division of Biomaterials, Institute of Biomaterials & Bioengineering, Tokyo Medical and Dental University, Tokyo, Japan; [6]Pharmacology, Department of Hard Tissue Engineering, Graduate School, Tokyo Medical & Dental University, Tokyo, Japan

E-mail: drsrihas@gmail.co

The aim of the study was to evaluate the initial cell morphology and proliferation on zirconia surfaces that were sandblasted using ceramic particles of different chemical composition and size.

Rat bone marrow cells were cultured on zirconia discs that were prepared by sandblasting with carborundum, alumina or zirconia particles. The surface roughness of the discs was quantitatively assessed by laser profilometer and was qualitatively observed by scanning electron microscope (SEM) and the surface chemical composition was analyzed by energy dispersive x-ray spectrometer (EDS). Subsequently, the cell morphology was visualized by scanning electron microscope. Furthermore, the number of viable cells was determined using a colorimetric assay kit.

Surface profilometry revealed that the carborundum blasted surface had a higher average roughness (Ra) value followed by alumina and zirconia blasted surfaces. EDS detected the presence of residual ceramic particles on both carborundum and alumina blasted surfaces.

The morphology initially revealed globular cells with filopodia (cytoplasmic processes). The cells then progressively elongated, eventually flattened and expanded over the entire material surface by day 3. This morphology appeared more pronounced on the carborundum and alumina blasted surfaces. In the case of cell proliferation, the zirconia blasted surface appeared to support more cell growth when compared to carborundum and alumina blasted surfaces.

The initial cell morphology appeared to be influenced by surface roughness while the cell proliferation did not. The residual contaminants on the surface of the discs seems to affect the initial cell viability.

P-04

Extremophilic Reduction of Graphene Oxide: An Avenue Towards Electronic Devices

Neha Chauhan[1], Sreejith Raveendran[1], Yoshikata Nakajima[1], Higashi Toshiaki[1], Shunji Kurosu[1], Y. Tanizawa[2], R. Tero[2], Yasuhiko Yoshida[1], Tatsuro Hanajiri[1], Toru Maekawa[1], Adarsh Sandhu[2] and D. Sakthi Kumar[1]

[1] *Bio-Nano Electronics Research Centre, Graduate School of Interdisciplinary New Science, Toyo University, 2100, Kujirai, Kawagoe, Saitama 350-8585, Japan*

[2] *Electronics-Inspired Interdisciplinary Research Institute (EIIRIS), Department of Electrical & Electronic Information Engineering*

Toyohashi University of Technology, Toyohashi, Japan

E-mail: nehachauhan16@gmail.com/ sakthi@toyo.jp

Green extremophilic reduction of graphene oxide (GO) was performed to produce large area, highly conductive graphene-sheets. It has been characterized using various techniques and the electrical conductivity measurements were made to estimate its electrical behavior.

Halophilic bacteria, salt loving extremophiles that can withstand harsh environmental conditions, were demonstrated to be appropriate candidate to effectively replace the utilization of various toxic chemicals and organic compounds to reduce GO. We have grown moderately halophilic bacteria *Halomonas eurihalina* and *Halomonas maura* in a medium incorporated with GO. Microbial reduction experiment was performed under two different conditions - aerobic and anaerobic conditions. Biologically reduced GO was characterized using TEM, AFM, XPS and Raman spectroscopy. The electrical properties of GO and reduced GO were characterized at room temperature using three-probe electrical measurement setup by fabricating the field-effect transistors (FETs) to confirm the reduction of GO after interaction with the bacteria.

The graphene-sheets obtained after bacterial reduction is having single to few layer sheets. An average size of graphene sheet is found to be 1-30 μm. The average thickness of reduced GO lies in the range of 0.8-1.0 nm. The resistivity of GO was estimated to be 3×10^{3} Ω-m. However, after reduction the resistivity value remarkably decreased to 1.3×10^{-2} Ω-m and 2.5×10^{-2} Ω-m. Thus, by employing extremophiles in GO reduction we explore novel ways of eco-friendly synthesis of graphene in nanotechnology.

We believe that the present green and cost effective avenue towards GO reduction would greatly contribute to the biomedical and electronic applications of graphene.

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P-05

Water Soluble Silicon Quantum Dots For Delivery of Nucleic Acid Drugs

Shanmugavel Chinnathambi[1, 2], Singaravelu Ganesan[2] and Nobutaka Hanagata[1,3]

[1]*Biomaterials Unit, National Institute for Materials Science (NIMS), Tsukuba, Japan*
[2]*Department of Medical Physics, Anna University, Chennai, India*
[3]*Interdisciplinary Laboratory for Nanoscale and Technology, NIMS, Tsukuba, Japan*
E-mail: Chinnathambi.Shanmugavel@nims.go.jp, sganesan@annauniv.edu, Hanagata.Nobutaka@nims.go.jp

Quantum dots (Qds) are popular replacements for fluorescent dyes in biological imaging, because QDs are highly stable against photobleching. CdSe Qds with a ZnS shell has been most used for biological imaging, but the application of CdSe Qds is limited because of their toxicity. In addition to the application of imaging, QDs are also attractive for nucleic acid drug delivery because of high loading capacity of drugs that is attributed to their smaller sizes. Unmethylated cytosine-phosphate-guanine oligodeoxynucleotides widely present in bacterial and viral DNA and it's activate cells of the immune system like dendritic cells, NK cells, macrophages and B lymphocytes. Researchers have shown that CpG oligodeoxynucleotides upregulates the proinflammatory cytokines such as IL-6, IL-12, IFN-α. As a result, the CpG oligodeoxynucleotides can be used in therapeutics for various illnesses, such as cancer, infectious disease, allergic disease and tumors. We addressed preparation of silicon QDs (Si QDs) for delivery and imaging of CpG oligodeoxynucleotide (CpG ODN), one of the nucleic acid drugs[2]. Silicon is group IV semiconductor and known as biocompatible materials. Si QDs are prepared in low-pressure nonthermal plasma of Ar and SiH_4[1]. To load negatively charged CpG ODN on the surface of Si QDs, the surface was modified by PEG-600 with different percentages. The PEG loaded Si QDs were used for delivery of CpG ODN and biological imaging.

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P-06

Interstitial Carbon Activates Transition Metals For Energy-Conversion Catalysis

Nor A. Fadil,[†,‡,§] Saravanan Govindachetty,[†] Futoshi Matsumoto,[§§] Hideki Yoshikawa,[⊤] Yoshiyuki Yamashita,[⊤] Shigenori Ueda,[⊤] Keisuke Kobayashi,[⊤] Toyokazu Tanabe,[†] Toru Hara,[†] Gubbala V. Ramesh,[†] Shinsuke Ishihara,[ǀ] Hideyuki Murakami,[†] Kazuhiko Noda[‡], Katsuhiko Ariga[ǀ,⊥] and Hideki Abe[*,†,¶]

[†]*National Institute for Materials Science (NIMS), 1-1 Namiki, Tsukuba, Ibaraki 305-0044, Japan*
[‡]*Shibaura Institute of Technology, 3-7-5 Toyosu, 135-8548 Tokyo, Japan*
[§]*Universiti Teknologi Malaysia, 81310 Skudai, Johor Bahru, Johor, Malaysia*
[§§]*Kanagawa University, 3-27 Rokkakubashi, Yokohama, Kanagawa 221-8686, Japan*
[⊤]*Synchrotron X-ray Station at SPring-8, National Institute for Materials Science (NIMS), 1-1-1 Kouto, Sayo, Hyogo 679-5148, Japan*
[ǀ]*MANA, National Institute for Materials Science (NIMS), 1-1 Namiki, Tsukuba, Ibaraki 305-0044, Japan*
[⊥]*CREST, Japan Science and Technology Agency (JST), 1-1 Namiki, Tsukuba, Ibaraki 305-0044, Japan*
[¶]*PRESTO, Japan Science and Technology Agency (JST), 4-1-8 Honcho Kawaguchi, Saitama 332-0012, Japan*
E-mail: Abe.Hideki@nims.go.jp

Abundant transition metals and their alloys potentially can be a realistic alternative to precious-group metals (PGMs) as the catalysts for energy applications including air-batteries, solar fuels, and polymer-electrolyte fuel cells. Here we demonstrate that interstitial insertion of a small atom, carbon, can dramatically activate transition metals for energy-conversion catalysis. Ordered interstitial phase of Ni and carbon, Ni_3C, was synthesized in the form of nanoparticles, by thermally decomposing aromatic-coordinated Ni clusters that were obtained through chemical reduction of nickel cyclopentadienyls in dry ether. Ni_3C nanoparticles exhibited much superior activity to Ni nanoparticles toward a half-cell reaction of direct borohydride fuel cells, the electrooxidation of sodium borohydride, in terms of the very low onset potential that was competitive to Au nanoparticles. The interstitial insertion of small atoms is a powerful strategy to activate transition metals for energy-conversion catalysis and will help address the energy challenges that we face.

P-07

Hydrothermal Approach Towards Agglomeration Free Radially Assembled Copper (Ii) Oxide Nanocrystals

Malar Auxilia Francis,[1,2] Shinsuke Ishihara,[3,4] Saikat Mandal,[3] Arivuoli Dakshanamoorthy,[2] Katsuhiko Ariga,[3,4] and Hideki Abe[1]

[1]National Institute for Materials Science (NIMS), 1-1 Namiki, Tsukuba, Ibaraki 305-0044, Japan

[2]Crystal Growth Centre, Anna University, Chennai, Tamil Nadu 600 025, India

[3]World Premier International (WPI) Research Center for Materials Nanoarchitectonics (MANA), National Institute for Materials Science (NIMS), 1-1 Namiki, Tsukuba, Ibaraki 305-0044, Japan

[4]Japan Science and Technology Agency (JST), Core Research for Evolutional Science and Technology (CREST), Go-bancho, Chiyoda-ku, Tokyo 102-0076, Japan

E-mail: Abe.Hideki@nims.go.jp

Three-dimensional (3D) hierarchical functional nanomaterials with specific morphology has been of great interest due to their novel physical and chemical properties[1-2]. The effect of shape tailoring in nanomaterials maximizes the surface area with sustainable high performance; in addition miniaturization in device fabrication can be achieved. Herein we report the synthesis of agglomeration free radially assembled copper(II) oxide (CuO) nanocrystals by single step hydrothermal technique. The hydrothermal reaction was mediated by ethylene glycol; leading to the formation of self assembled nanosheets with thickness of about 20-30 nm. The synthesized material was confirmed to be pure CuO through XPS analysis and the major surface of single crystalline nanosheets were indexed as {001} by selected area diffraction. The thickness of the single crystalline nanosheets and size of the self-assembled three-dimensional architectures were found to be tunable by varying the reaction conditions.

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P-08

Identification of Anticancer Nano-Reagents by Mortalin Staining

Ran Gao, Sunil Kaul and Renu Wadhwa

National Institute of Advanced Industrial Science & Technology (AIST)
Central 4, 1-1-1 Higashi, Tsukuba, Ibaraki 305-8562, Japan
E-mail: ran-gao@aist.go.jp

Increasing rate of cancer and complexity of its treatment has prioritized the search for new anticancer natural and synthetic nano-reagents. We have earlier reported that the heat shock family 70 protein, mortalin, has pancytoplasmic distribution pattern in normal and perinuclear in cancer human cells. Using mortalin staining as a model reporter, we screened human shRNA library and have identified nine candidate anti-cancer shRNAs. An independent Comparative Genomic Hybridization (CGH) analysis of 35 cancer cell lines revealed that the five (NBS1, BRCA1, TIN2, MRE11A, KPNA2) of the nine genes were located on the chromosome regions identified as the gain-of-locus in more than 80% of the tested breast cancer cell lines. By gene specific PCR, the target genes of the five identified shRNAs were found as frequently amplified in cancer cell lines. By bioinformatics analyses, we found that the identified targets were connected to MRN (MRE11-RAD50-NBS1) complex, the DNA damage-sensing complex. We demonstrate that the identified shRNAs triggered DNA damage response and induced tumor suppressor $p16^{INK4A}$ causing growth arrest and loss of malignant properties of cancer cells. Taken together, we demonstrate that mortalin-staining pattern served as a reliable screening method for identification of anti-cancer shRNAs and could be extended to screening of the anti-cancer potential of natural and synthetic nano-materials.

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P-09

NIR Quantum Dots: Therapeutic Efficacy For Photo-Thermal Cancer Therapy And Deep Tissue Imaging

Ravindran Girija Aswathy, Balasubramanian Sivakumar, Yutaka Nagaoka, Yasuhiko Yoshida, Toru Maekawa and D. Sakthi Kumar

Bio Nano Electronics Research Center, Graduate School of Interdisciplinary New Science, Toyo University, Kawagoe, Saitama, 350 - 8585, Japan
E-mail: aswathyrg@gmail.com, sakthi@toyo.jp

Quantum dots (QDs) have gained a great deal of attention owing to their remarkable photophysical properties that include high fluorescence quantum yield (QY), superior stability against photobleaching, a narrow and symmetric emission spectrum and a broad and continuous excitation spectrum. These characteristic properties make QDs superior fluorescent probes to organic fluorescent dyes and proteins for in vitro and in vivo biomedical imaging applications. Among different imaging modalities, optical imaging techniques have attracted great interest in the diagnostic process due to their easy operation, better temporal resolution, and relative low cost. Since most tissue chromophores, including oxyhemoglobin, deoxyhemoglobin, and melanin, exhibit comparatively weak absorbance in the near infrared (NIR) spectral range (700– 900 nm), intense research efforts have been placed on the development of NIR probes. In fact, NIR techniques have been designed to diagnose diseases, monitor the response to therapeutic treatment, track tumor development, and metastases, as well as evaluate the rehabilitation. NIR optical imaging has also been applied on pharmaceutical research, such as monitoring the biodistribution of drugs, and visualizing the targeted delivery of drug carriers in living animal subjects.

In addition to imaging applications, QDs have potential in cancer photodynamic therapy as photosensitizers, since ultraviolet (UV) light and laser irradiation can induce them to generate reactive oxygen species (ROS) such as .OH and $.O_2^-$, cytotoxic single oxygen ($^1O_2$) and toxic heavy metal ions. Majority of the work on QD biomedical applications as of yet has been focused on fluorescence imaging and very little has been exploited the efficacy of QDs for cancer therapy.

In our study, we report on a unique property of the NIR QDs with brown or close to black colors in bright fields namely that they can rapidly convert light energy into heat after laser irradiation. This property is potentially useful for cancer photothermal therapy and was exploited for imaging cancer cells.

P-10

Strain Rate Dependence of Microstructural Evolution In Az80mg Alloy During Mdfing

Yuichi Hirose[a] and Hiromi Miura[b]

Department of Mechanical Engineering and Intelligent Systems, UEC Tokyo (The University of Electro-Communications), Chofu, Tokyo 182-8585, Japan

[a]*E-mail: h1132066@edu.cc.uec.ac.jp*

[b]*E-mail: miura@mce.uec.ac.jp*

A commercial Mg alloy AZ80 was multi directionally forged (MDFed) under decreasing temperature conditions from 643K to 473K at various strain rates of 3 x 10^{-1}~10^{-3} s^{-1} up to cumulative strain of =2.4. For MDFing, a pass strain of = 0.6 was employed. The average grain size decreased gradually with cumulative strain. The faster the forging strain rate was, the finer the average grain size became. After straining to =2.4 (i.e., after 4 passes of MDF) at a strain rate of 3 x 10^{-1} s^{-1}, ultrafine grains (UFGs) with an average size of about 400 nm were uniformly evolved. In that case, high Vickers hardness of 1.1 GPa was achieved. Although the yield stress was raised up to 380MPa with decreasing grain size, the ductility was not so changed, i.e., around 17%. Such superior mechanical properties of the MDFed AZ80Mg alloy should be caused by strengthening due to UFGed structure and the work hardening and by good formability probably due to grain boundary sliding and grain orientation randomization. Because of its deformability, the AZ80Mg alloy MDFed accepted further cold rolling at room temperature. 10% reduction raised the yield stress to 420MPa, and then, quite high ultimate tensile strength of 500MPa was accomplished.

P-11

Pulsed Neutron Scattering Facility at J-PARC

Takashi Ino

KENS – Neutron Science Division, Institute of Materials Structure Science
KEK, Tsukuba, Ibaraki 305-0801, Japan
E-mail: takashi.ino@kek.jp

The neutron provides positions of nucleus (atomic structure) and magnetic structure in materials. The accelerator driven neutron source, often called as "the pulsed neutron source," began in Japan during 1970s. In KEK, a user facility of a pulsed neutron source named KENS had been operated from 1980 to 2006 and developed variety kinds of techniques and devices in collaboration with universities and laboratories in abroad. Based on the innovative development, the world's most intense pulsed neutron facility at Japan Proton Accelerator Complex (J-PARC) was constructed and started user program in 2008. KEK has constructed 6 state-of-art neutron scattering instruments covering fundamental physics researches to battery materials studies.

P-12

Single Walled Nanotubes As Drug Delivery Vehicles

Prashanti Jeyamohan, Athulya Aravind, Y. Yoshida,
T. Maekawa and D. Sakthikumar

Bio Nano Electronics Research Centre,
Graduate School of Interdisciplinary New Science,
Toyo University 350-8585, Kawagoe, Saitama, Japan
E-mail: prashanti.andrew@gmail.com, drsakthi@gmail.com

Life threatening disease cancer continues to increase with increasing age of the population and urbanization. In recent years, while medical science and bio-medical engineering has advanced to significant extent the cure for cancer is still not in sight.

In a number of situations, the malignancy of tumors is detected at advanced stages when administration of chemotherapeutic drugs is toxic to healthy cells. In the attempt to improve these conditions the approaches to explore targeted drug delivery and detect cancer cells at an early stage are of particular interest. An ideal tumor targeting drug delivery system combines tumor recognition moiety with drug loaded vesicles such that the drug is delivered and released in a selective and discriminatory fashion. Such a system not only improves the efficacy of the drugs but also minimizes the system toxicity to improve the quality of the patient life.

Here we describe a type of drug delivery system that is triggered by changes in pH based on single walled carbon nanotubes(SWNT), modified with carboxylate groups and coated with a biocompatible material and loaded with the an anti-cancer drug doxorubicin(DOX). The drug binds at physiological(pH 7.4) and is released at a lower pH (i.e, lysosomal pH) or the pH characteristics of certain tumour environments. Folic acid (FA), a targeting agent, was also additionally tethered to the SWNT to selectively deliver DOX into the cancer cells with much higher efficacy than pure DOX. The DOX released from these modified nanotubes has been shown to inhibit the cell proliferation. Thus, this drug delivery system is promising for high treatment efficacy and low side effects for future cancer therapy.

P-13

Possibility of Integration of Medical Data Using Mobile Van Clinic And Virtual Conference

Jitsuzo Katsumata [1] , Tetsuya Toma[1,2] and Tetsuro Ogi [1]

[1] Graduate School of System Design and Management Keio University
[2]Keio Photonics Research Institute, Keio University, Yokohama, Kanagawa, Japan
E-mail: ktboy@chime.ocn.ne.jp

Rural clinics in developing countries have problems of insufficient medical equipments, doctors and nurses, while quality level of urban general hospitals is similar to that of advanced countries. In case of local villages, a gap between urban and rural areas is opening. We propose a telemedicine system, mobile van clinic and virtual conference from the viewpoint of medical quality improvement.

The purpose of our research is to assist rural hospitals with the same quality of clinic performance as that of urban general hospitals. This research covers from the introduction of the telemedicine system, mobile van clinic and virtual conference. Also the research explores a possibility of quality improvement measures using the referral system, which has close relationship between urban and rural medical institutions.

We proposed the concentration of medical data in regional core village. By that it was able to classify easily the diseases in each regional area using Diagnosis Procedure Combination (DPC) and Mobile Van Clinic. And we simulated to send Van to local village taking appropriated medical devices into consideration, which led to adjusting medical cost for regional areas.

We could classify the diseases in each regional area using DPC system. And diseases were easily classified by the name of region, type of diseases. As a result, this system can be promising as healthcare cost is decreased in rural villages.

We confirmed that the referral system would be feasible based on the mobile van clinic system including diagnoses. And the Van is provided through the clinics in rural villages that are equipped with telecommunication facility connected to urban hospitals.

P-14 Flow Control Application Studies For Spaceplane Type High Speed Vehicles

Shashank Khurana and Kojiro Suzuki
Department of Advanced Energy, EN-C, Suzuki Laboratory, 2F, Experimental Building
Division of Transdisciplinary Sciences, Graduate School of Frontier Sciences (G.S.F.S.)
The University of Tokyo, 5-1-5 Kashiwanoha, Kashiwa City, Chiba 277-8561
E-mail: khurana.shashank@gmail.com

Hypersonic Flow is defined as that regime in which certain key physical flow phenomena becomes important and can no longer be predicted / defined by the conventional Gas flow equations. This regime exists beyond Mach 5 (About 2.5 times that of *Commercial Air-Plane Concorde),* where Mach number is a non-dimensional flow parameter equivalent to the ratio of vehicle speed to the speed of sound in its ambiance. At such speeds, the Kinetic Energy of Flow gets converted into the Internal Energy thereby raising the temperatures at the Stagnation point (forward-most point of the vehicle where the flow comes to a stop) and vicinity of the vehicle. With the advent of human desire to travel faster and faster, the efforts to design superior vehicles have been speeded up to cater the new dimension of needs. For flights at very high speeds, the problem of Aerodynamic drag (the resistance offered by the air-flow to the frontal area of vehicle) and Aerothermodynamics (the convective heat transfer from the ambient air to the vehicle body) is innate for the vehicle design. With a thorough literature review of the past research, it has been proclaimed by the researchers that the drag and heat transfer are a function of vehicle's geometry and the trajectory followed. With trajectory being fixed for the Mission, the vehicle design must be given the foremost importance for the safety of inner load-carrying structure under such hostile conditions. The hostility of the conditions in the vicinity of the vehicle can be judged by a fact that at elevated temperatures, owing to the dissociation and ionization of Oxygen and Nitrogen into atoms and ions, the electromagnetic signals are absorbed thereby causing a communication blackout from ground. The current research focuses on the optimization of entire flow field around the body, controlling it favorably for the minimization of heat transfer and the resistance offered to the vehicle without any negligible weight addition, by appropriate geometry modification and with the use of passive techniques including Aerospikes (extended surfaces in front of the vehicle weakening the high speed wave) and Breathing Blunt Nose (bleeding the high pressure air from the nose and discharging at the base, that is generating auxiliary thrust). These techniques have been studied in past researches only on simple basic geometries but their applications to full representative vehicle haven't been investigated yet. Hence, the efforts were made for different parametric testing of these two techniques on scaled-down models of standard NASA vehicle configurations. The result shows that considerable reduction in drag (about 5-10 %) and heat transfer (about 15-20 %) is possible and hence they hold significant feasibility for practical applications, such that they can be employed for economical, reliable and safe futuristic vehicles for hypersonic intercontinental commercial transportation.

P-15

Temperature Dependence of Local Structure Change In Lithium Peroxide

Yoshitaka Matsushita,[a] Koichi Momma,[a,b] Fujio Izumi,[a] and Yoshimi Kubo[a]

[a]*National Institute of Materials Science, 1-2-1 Sengen, Tsukuba, Japan,*

[b]*National Museum of Nature and Science, 4-1-1 Amakubo, Tsukuba, Japan*

E-mail: MATSUSHITA.Yoshitaka@nims.go.jp

Recently, on environmental issues / energy situation, material development related to next generation energy source with low environmental load type is important and essential issues than ever before. One of the possible energy sources for mobile usage in next generation is lithium secondary (rechargeable) batteries (lithium-air battery). If we can use the Li-O_2 system for new batteries, the expected specific energy density (> 5,000 Wh/kg) is much higher than them in current systems. The simple and classic compound Li_2O_2 is one of the key materials to develop the newer system. In newly developing batteries, Li_2O_2 is crystallized on cathode material under $2Li + O_2$ reversible reaction during charging and discharging process. This crystallization leads to cathode clogging phenomena and then result in lowering of output. [1] Therefore, to well-understand Li_2O_2 properties including crystallography is very essential and important for developing new battery with controlled stable output. However, surprisingly even now, the crystal structure of simple and classic compound Li_2O_2 is still unknown: two crystal structure models are proposed only. [2] In this study, to identify the crystal structure of Li_2O_2 and its local structure change, we had carried out powder synchrotron x-ray diffraction measurements from around 85 K to 300 K, using angular high-resolution powder diffractometer installed at the BL15XU, SPring-8 (λ = 0.65297 Å). All process for sample preparation were carried out under dry Ar atmosphere: the sample was ground well and packed into a Lindenmann glass capillary of 0.3 mm diameter, after then the capillary was sealed. From this study, we concluded that the crystal structure of Li_2O_2 takes one of the previously proposed models ($P6_3/mmc$) [2], and the compound does not show any phase transitions in the temperature range. The details will be presented.

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P-16

Trafficking And Superior Therapeutic Proficiency of Hybrid Lipid Nanoparticles Encapsulating The Ribosome Inactivating Protein-Curcin Across *In Vitro* Blood Brain Barrier

M. Sheikh Mohamed, Srivani Veeranarayanan, Ankur Baliyan, Aby Cheruvathoor Poulose, Yutaka Nagaoka, Hiroaki Minegishi, Yasuhiro Shimane, Yasuhiko Yoshida, Toru Maekawa and D. Sakthi Kumar

Bio Nano Electronics Research Center, Graduate School of Interdisciplinary New Science
Toyo University, Kawagoe, Saitama, 350-8585, Japan
E-mail: m.sheikhmohamed@gmail.com / sakthi@toyo.jp

Surpassing the physiological barrier of the brain, the blood brain barrier (BBB), has been one of the most arduous tasks, in the treatment of various brain disorders from Alzheimer's to cancer. The present initiative was formulated to overcome this complication by attempting to deliver a lipid-polymer hybrid nanoparticle with a potent therapeutic payload and imaging agent across a BBB model specifically to brain cancer cells. The nanocarrier employed is the solid lipid nanoparticle prepared via the co-acervation method. The particles were uniformly spherical, 50-250 nm in size, with intriguing resemblance to fluid mosaic model, as the parent hybrid nanoparticles were found to be interspersed by tiny vesicles. The therapeutic component of the nanoformulation was the potent ribosome inactivating protein, curcin, which has been earlier proven to exert superior toxicity to cancer cells and possible suppression of metastasis. The nanoparticles efficiently crossed the BBB mimic formulated of the endothelial HUVECs. The nanoformulation was highly biocompatible to normal HUVEC and HCN-1A cell lines in its void version. Folate targeted nanoparticles were effectively internalized by brain cancer Glioma cell lines imparting superior toxicity, whereas the normal cell lines were efficiently spared. The sturdy drug release from the nanoparticles was one of the highlight achievements of this report, with steady release recorded upto 72 h. Anti-apoptotic survivin and cell matrix interaction protein vinculin were highly suppressed on curcin-nanoparticle exposure. This combination of a competent nanoparticle, a potent toxin and an efficient targeting scheme developed into a lethal and proficient anti-cancer nanoformulation, bypassing the *in vitro* BBB model and exerting superior therapeutic effects on brain cancer cells.

P-17

Footprints of IOD And Enso In The Kenyan Coral Record

Nobuko Nakamura,[1*] Hajime Kayanne,[1] Hiroko Iijima,[1]
Timothy R. McClanahan,[2] Swadhin K. Behera,[3] and Toshio Yamagata[1,3]

[1]*Department of Earth and Planetary Science, University of Tokyo, Tokyo, Japan*
[2]*Marine Programs, Wildlife Conservation Society, Bronx, New York, USA*
[3]*Research Institute for Global Change, Japan Agency for Marine-Earth Science & Technology, Yokohama, Japan*
E-mail: nobunobu@eps.s.u-tokyo.ac.jp

The Pacific El Nino/Southern Oscillation (ENSO) and the Asian monsoon have been considered the major influences on the climate variability in the Indian Ocean. However, the correlation between the ENSO and Indian Ocean climate variability has become weak in recent decades. In 1999 the Indian Ocean Dipole (IOD) was identified as another dominant climate mode generating climate variability not only in the Indian Ocean but also in the world along with ENSO [*Saji et al.*, 1999]. But their past variations are obscure due to a lack of reliable instrumental observations.

We found Kenyan coral oxygen isotope ratio (delta Oxygen) in January reflected the East African Short Rain anomaly for the previous Sep–Nov related to the IOD, and reconstructed the 115-year coral IOD index. The coral IOD periodicity has been changed from decadal to quasi-biennial through the 20th century. The mode shift has also coincided with an intensified coupling with Indian summer monsoon rainfall. We suggest that a warming of the western Indian Ocean has attenuated and replaced the El Nino Southern Oscillation effect over the Indian Ocean [*Nakamura et al.*, 2009].

On the other hand, a comparison of the monthly coral delta oxygen pattern corresponding to IOD and ENSO years shows that the El Nino-induced signals do not appear clearly as the positive SST and rainfall anomalies in the Kenyan coral record. Moreover the coral records indicate that the negative IOD like- anomalously cold SST condition in the western Indian Ocean precedes the evolution of the Pacific El Nino by one year. The anomalously cold SST condition was prominent in the late 19th century, but weakened in the 20th century. This retreat of the cold SST condition due to warming of the western tropical Indian Ocean may influence the nature of the Pacific ENSO [*Nakamura et al.*, 2011].

P-18

Hydrogen-Induced Microstructure Changes of $RENi_2$ Laves Compounds (RE = La, Pr, Gd)

Ihho Park and Eiji Abe

Department of Materials Engineering, University of Tokyo
7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8656, Japan
E-mail: park@stem.t.u-tokyo.ac.jp

For AB_2 Laves compounds with C15-type structure, hydrogen-induced-amorphization (HIA) seems to be a well-established phenomenon; their crystalline order is believed to be fully transformed into amorphous structure after a hydrogen charge-discharge process. Occurrence of HIA is empirically well summarized based on the critical atomic-size ratio between the constituent elements (i.e., R_A/R_B) as being ~1.37 [1]. So far, the HIA has been mostly confirmed by X-ray diffraction. In the present work, we investigate the hydrogenation-induced microstructure changes of $RENi_2$ Laves compounds (RE = La, Pr, Gd), by using transmission electron microscopy (TEM) and electron energy loss spectroscopy (EELS). We find that the microstructures of the present $LaNi_2$, $PrNi_2$, $GdNi_2$ are not pure amorphous but composed of Ni nanocrystals embedded in amorphous matrix of hydride REH_{2+x}, providing a direct evidence of hydrogen-induced micro-phase separation (HIMPS). Accordingly, we conclude that HIA believed so far is actually attributed to the micro-phase separation phenomenon. We interpret the occurrence of HIMPS based on an exothermic heat during the hydrogenation, as provided by a large hydride formation enthalpy (*DH*); the value of − 50 $kJ/mol{\cdot}H_2$ reasonably defines a new critical line to replace the previous atomic-size critical for HIA (i.e., HIMPS). The hydride formation enthalpy of various Laves compounds were estimated based on Miedema's semi-empirical model [2]. The present *DH*-based criterion is shown to be applicable for a large number of C15-type AB_2 Laves compounds, and also explains fairly well why the external heat assists are essentially necessary to promote HIMPS for the compounds located close to the critical boundary.

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P-19

Synthesis And Utilization of Cu_2S Nanocrystals As Photothermal Ablators of Cancer Cells

Aby Cheruvathoor Poulose, Srivani Veeranarayanan,
Yasuhiko Yoshida, Toru Maekawa and D. Sakthi Kumar

Bio Nano Electronic Research center, Graduate School of Interdisciplinary New Science,
Toyo University, Kawagoe, Saitama, Japan
E-mail: abypoulose@gmail.com, sakthi@toyo.jp

A simple colloidal approach is developed to prepare size- and shape-controlled copper (I) sulfide (Cu_2S) NCs in a mixture of oleylamine and 1-octadecene at a relatively high temperature without using any pyrophoric ligands. The parameters such as reaction time, temperature and concentration of surfactant, oleylamine were constantly varied and the resultant particles were analyzed. The crystal structure, chemical composition and morphology of the as-obtained products were characterized by XRD, XPS, TEM and SEM. In addition optical characteristics, band gap calculation and FT-IR analysis were also carried out. The morphology and size of the Cu_2S NCs could be easily controlled by adjusting the reaction parameters. The shape and size of the NCs were seen to be affected with the change in reaction conditions under study. These NCs were found to be NIR responsive due to localized surface plasmon resonance. The application of these nanocrystals as photothermal ablators and photo sensitizers for cancer cell destruction was studied in vitro. This nanocrystal was found to be biocompatible and safe for cancer imaging and treatment via triggerable methods without any collateral damage to normal cells.

P-20 Precipitation Strengthening In A Mg-Zn-Y Alloy

Julian M. Rosalie[1], Hidetoshi Somekawa[1], Alok Singh[1] and Toshiji Mukai[2]

[1]*National Institute for Materials Science (NIMS), Tsukuba, Ibaraki, 305-0047, Japan*

[2]*Dept. Mechanical Engineering, Kobe University, 1-1 Rokkodai, Nada, Kobe city, 657-8501 Japan*

E-mail: Rosalie.julianmark@nims.go.jp

Precipitation strengthening of a heat-treatable Mg-Zn-Y alloy has been examined quantitatively, revealing important differences between this alloy and binary Mg-Zn alloys. Heat-treatment is used to strengthen Mg-Zn alloys by precipitating a fine distribution of nanoscale, rod-like particles termed β'. Although similar precipitates form in Mg-Zn-Y alloys, there has been no previous quantitative work on the extent of the precipitation strengthening response.

In this work, a Mg-Zn-Y alloy was extruded to generate texture, aligning the grains so as to prevent the formation of crystallographic twins. The alloy was then deformed in tension to provide controlled amounts of crystallographic defects (dislocations) and held at an elevated temperature (150^{o}C) to form β' precipitates. The size, number density and volume fraction of precipitates was measured by transmission electron microscopy in order to quantify the effect on the strength and ductility of the alloy.

If no deformation was applied the amount of β' precipitates formed was only 0.5% by volume, compared to 3.5% in a similar Mg-Zn alloy with no yttrium [1]. This was due to the precipitation of a coarse quasicrystalline ternary phase rather than nanoscale β' precipitates. These coarse ternary phase particles provided limited strengthening and there was little improvement in mechanical properties. Deforming the alloy prior to ageing assisted in the nucleation of the rod-like β' phase. This not only reduced the average precipitate length and diameter but also increased the total amount of rod-like β' precipitates to approximately 2.3% by volume [2]. This was in contrast to Mg-Zn alloys, where deformation affected the size, but not volume fraction, of the precipitates. The combination of increased volume fraction together with reduced precipitate size and spacing increased the yield strength of Mg-Zn-Y alloys after 5% deformation and isothermal ageing by 32% to 287 MPa, compared to a 13% increase in a similarly-treated Mg-Zn alloy. The β' precipitates were the dominant influence on both strength and ductility and the mechanical properties of the Mg-Zn-Y alloy had a similar dependence on the size and spacing of the β' precipitates to Mg-Zn alloys.

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P-21

Conjugation of Novel Anti-Mortalin Antibodies With Quantum Dots For Bio-Imaging

Jihoon Ryu, Tomoko Yaguchi, Renu Wadhwa and Sunil Kaul

National Institute of Advanced Industrial Science & Technology (AIST)
Central 4, 1-1-1 Higashi, Tsukuba, Ibaraki 305-8562, Japan
E-mail: s-kaul@aist.go.jp

Recent progress in stem cell research has prioritized the refinement of cell labeling techniques for *in vitro* and *in vivo* basic and therapeutic studies. Although quantum dots (QDs), because of their optical properties, are emerging as favorable nanoparticles for bio-imaging, substantial refinements are still required to improve their biocompatibility including low toxicity, high stability, high efficiency and cell-specific targeting features. In the process of molecular characterization of stress protein, mortalin, we generated multiple antibodies and discovered that some of these have cell-internalizing characteristics. Using such property of antibodies, we generated internalizing QDs (iQDs) by conjugation of QDs with the internalizing antibody. Cells incubated with iQDs were illuminated (i-Cells) and were suitable for long-term imaging. Earlier we showed that the i-Cells retain their normal structure and functional characteristics. These cells proliferated normally and underwent normal differentiation *in vitro* and *in vivo* suggesting the potential use of i-QDs in diagnostics and regenerative medicine. We demonstrate cell-internalizing potential of newly raised anti-mortalin antibodies and their use in generation of i-Cells and imaging protocols.

His-tagged recombinant mortalin protein was prepared in bacteria and purified by NTA nickel to about 98% purity. The pure protein was used as an antigen to generate polyclonal and monoclonal antibodies in rabbit and mouse, respectively. Specificity and cell internalizing features of the new antibodies were investigated by biochemical and imaging assays.

We obtained new polyclonal and monoclonal antibodies against mortalin protein. Antibody specificity analyses by western blotting and immunoprecipitation revealed that the new polyclonal antibody (B-81) was highly specific. The antibody also revealed cell internalization property wherein the cells incubated with the antibody showed positive staining when incubated with the FITC-labeled anti-rabbit secondary antibody. However, the staining was weak suggesting that the antibody possess weak cell-internalizing activity. For monoclonal antibodies, amongst the 44 clones obtained, only 1/3rd showed strong and specific reactivity to mortalin on western blots. The rest 2/3rd were either negative or showed very weak activity. Amongst the 1/3rd, we identified 2 clones (B80-M2 and B80-M29) with high cell-internalizing activity. We demonstrate (i) cell internalizing feature of anti-mortalin antibodies and their use in generation of illuminating cells, (ii) generation of multicolor cells with quantum dots, (iii) involvement of mortalin in internalization phenomenon and (iv) a model on their application in diagnostic and regenerative medicine.

P-22

Toxicity of Tetrodotoxin And Mt Genome of Rare "Tumugihaze" *Yongeichthys criniger* Collected in Wakayama Prefecture

Yuji Hoshino[1], [1]Takasi Tetsu[1], Kedarnath Mahapatra[1], Kenji Nohara[1], Hiroyoshi Kohno[2], Toshio Saito[1]

[1]*School Of Marine Science And Technology, Tokai University, Shizuoka, Japan* [2]*Okinawa Regional Research Center, Tokai University, Okinawa, Japan*
E-mail: Tsaito@Scc.U-Tokai.Ac.Jp

Tumugihaze is a well-known goby fish bearing tetrodotoxin (ttx). Originally, the habitat of this species was the Southwest islands area, south of Amami Oshima island. However, for the first time it was reported from Kushimoto in Wakayama Pref. in 2000. It was not reported for a long time since then. Thus the toxicity of this species lived in Wakayama pref. was unknown. In order to understand the toxicity and possible Northward migration of tumugihaze from Southwest islands area, the toxicity and mt genome were investigated under the present study. In view of the difficulties associated with the collection of tumugihaze, only 8 specimens were collected at Kusimoto in Wakayama pref. During October 2010 to December 2011. The specimens were frozen after collection for further analysis in laboratory. Toxicity of different body parts such as skin, muscles, liver and genital gland were measured by the mouse assay method. The highest toxicity was 1,950mu/specimen in eight specimens collected from Kushimoto. It is worth noting from food safety point view that the minimum lethal dose (mld) of ttx in human is 10,000mu, thus consumption of 5 ttx-bearing tumugihaze could cause death. For comparison of mt genome of the specimens collected from two locations, d-loop areas of mt genome of 60 specimens of tumugihaze from Southwest islands area and 5 specimens from Kushimoto were used under the present study. Dna was extracted from a part of caudal fin of each specimen. And the base sequence of mt dna d-loop area of each fish was determined. The genealogical tree was created from those base sequences. It became clear that the haplotype of tumugihaze could be roughly divided into two clusters from a genealogical tree and the tumugihaze both from Amami Oshima island and Kushimoto belong to the same cluster. This result suggests that the source of tumugihaze from Kushimoto could be Amami Oshima island. On the other hand, tumugihaze from the Okinawa island, which is south of Amami Oshima island, belongs to a clearly different cluster from the group that of Amami Oshima and Kushimoto. Therefore there might be no hereditary exchange between tumugihaze from two clusters. We are presently trying to understand the role of climate change in northward migration of the tumugihaze in this region.

P-23

Inhibition of Hsp90 Chaperon Function Augments Doxorubicin Induced Cellular Senescence In Tumor Cells

Upasana Sarangi, Khanderao Paithankar, Jonnala Ujwal Kumar,
Vaidyanathan Subramanian and Amere Subbarao Sreedhar

Centre for Cellular and Molecular Biology (CSIR)
Uppal Road, Hyderabad 500 007
E-mail: upasana.sarangi25@googlemail.com

The molecular chaperone Hsp90 has been identified as a pharmacological target to combat cancer due to its involvement in the conformational stabilization and functional maturation of mutated oncogenic gene products. In the present study, we demonstrate functional role of Hsp90 in doxorubicin induced cellular senescence using human neuroblastoma tumor cells. Cells treated with Hsp90 inhibitor 17AAG (2 μM) either alone or in combination with doxorubicin (0.1 μM) resulted in enhanced cell death by 6 day treatment. However, compared to the combination treatment, cells pre-treated (1 day) with 17AAG followed by doxorubicin (5 days) showed significant cell cycle arrest and enhanced SA-β-galactosidase activity. The $p16^{INK4a}$ expression levels were unaffected but p53 and its transcriptional target $p21^{WAF}$ expression levels were considerably induced with increased senescence. However the senescence activation did not correlate with increased chromatin condensation and heterochromatin formation. The epidermal growth factor (EGF) treatment failed to reverse the senescence phenotype confirming the irreversible effect of our combination drug treatment. The kinase activity of ERK1/2 was found to be inhibited on the onset of senescence, nevertheless AKT activity was increased. The treatment of cells with mTOR inhibitors curcumin and rapamycin both established involvement of PI3K-AKT-mTOR pathway in senescence activation. The Hsp90 siRNA treatment in 4 day but not 2 day treatment inhibited tumor to senescence transition implying the functional requirement of Hsp90 in cellular transition. Knockdown of Hsp90 expression in senescence cells however was found to be lethal presenting that Hsp90 expression is indispensible for cell survival. Our findings demonstrate that chaperone protein, Hsp90 acts as a molecular switch in tumor to senescence transition.

P-24

Triad Analysis of Fuel Cycle Options For Nuclear Power Generation: Incorporating The Role of NSG In India

Saurabh Sharma

The University of Tokyo
E-mail: saursharma@gmail.com

Indian nuclear power program is world's leading stride with the vision of tremendous expansion of nuclear power generation by 2020 in India. After the civilian nuclear agreement with USA and NSG, India has the right to access both the technology and fuel from the NSG. This research demonstrates the impact of civilian agreement on India's nuclear program towards the development of LWRs. Chief motivation of this work lies on the economics of nuclear power as well as on the nuclear fuel cycle. Economics of nuclear power leads to the cost analysis of electricity generation by using nuclear fuel and technology. In the study of nuclear power economics, two components are worth mentioning, i.e., fuel cycle options/scenarios and cost associated with respective scenarios. Nuclear fuel cycle has two options, namely, direct disposal of spent fuel at the back end of nuclear fuel cycle after the reactor use and reprocessing of the spent fuel at the back end after the reactor use. Present study incorporates both the above scenarios and highlights the estimated results after the installations of LWRs with the cooperation of NSG. From the viewpoint of nuclear fuel waste management, reprocessing option increases the attractiveness of nuclear power generation. There are debates on the adoption of reprocessing option due to the high proliferation risk at the reprocessing facilities. In this concern, France is the largest supporter towards the use of reprocessing option and building the reprocessing facilities as well as minimizing the proliferation risk and optimize the waste nuclear fuel. Whilst, use of the reprocessing option for nuclear fuel cycle is not significantly high from the economics point of view, cost differences are fairly reasonable and explainable to convince the above study. In this research cost competencies for direct disposal and reprocessing options of nuclear fuel cycle have been discussed. In short, nuclear is the well attractive power generation source for the energy security worldwide considering the must constraint of lesser proliferation risk.

P-25

CARF - A Novel Marker For Safety Evaluation of Nano-materials

Rumani Singh, Caroline T. Cheung, Sunil Kaul and Renu Wadhwa

National Institute of Advanced Industrial Science & Technology (AIST)
Central 4, 1-1-1 Higashi, Tsukuba, Ibaraki 305-8562, Japan
E-mail: renu-wadhwa@aist.go.jp

CARF (Collaborator of ARF) was first cloned as an ARF-interacting protein and found to regulate ARF-dependent and -independent p53 functions that are central to the control of cell proliferation. We have earlier shown that CARF itself undergoes complex regulation by feedback and feedforward mechanisms in p53-MDM2-p21 pathway. Knockdown of CARF led to mitotic arrest, aneuploidy and apoptosis. We investigated the molecular mechanism of CARF silencing-induced apoptosis by employing a variety of cancer cell lines that varied in their genetic background. CARF compromised cells underwent apoptosis within 3-4 h post-transfection of CARF siRNA. We demonstrate that CARF is an essential survival protein.

Overexpression of CARF resulted in growth arrest of human cancer cells and induction of premature senescence in normal human cells. CARF was upregulated during replicative, oncogenic and stress induced senescence in cultured cells. We examined whether CARF could serve as a novel biomarker for cellular senescence by undertaking induced senescence in culture cells as model system. We demonstrated that it is an essential protein for cell division and viability. We demonstrate that CARF is involved in the mechanisms regulating cellular fate and hence could serve as a novel marker for safety of nano-biomaterials and nano-biomanipulations.

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P-26

Synthesis And Transport Properties of High Temperature Superconductivity In Iron-Based Oxypnictides

Shiv Jee Singh

Department of Applied Chemistry, The University of Tokyo, Bunkyo, Tokyo 113-8656 Japan and Japan Society for the Promotion of Science (JSPS), chiyoda-ku,Tokyo 102-8472 Japan
E-mail: tsjsingh@mail.ecc.u-tokyo.ac.jp

After almost a century of research, the challenges in superconducting materials still remain the same; observation of zero resistance state at very low temperature and difficulty in fabricating long length wires. In this respect, Kamihara et al. [*J. Am. Chem. Soc.* **130**, 3296 (2008)] has discovered a new type superconductor "Iron Based Superconductors (FeSCs)" in 2008 and lead to a landmark result that can potentially usher in new ideas for these challenges. Various families of FeSCs have been subsequently synthesized and investigated in which FeAs based oxypnictides (REFeAsO, RE-1111, RE = rare earth) gives the largest T_c of 56 K for this new superconductors. My work is based on RE-1111 (RE = Sm) family and trying to improve the superconducting properties with respect to transition temperature (T_c), critical current (J_c) and upper critical field (H_{c2}). To understand the role of this, we synthesized the polycrystalline F-doped Sm based oxypnictide $SmFeAsO_{0.8}F_{0.2}$ (Sm-1111) in wide heating temperature range (800-1100°C) to establish best heating temperature and studied by magneto-resistance, magnetic susceptibility and magnetization measurements. Our measurements confirmed the heating temperature 900°C is sufficient for fluorine doping and resulted in an increase in the transition temperature (T_c) and upper critical field (H_{c2}). The resistivity measurement confirmed the T_c (onset) of 57.5 K and corresponding Meissner transition at 56.3 K which is among the highest T_c in bulk Sm-1111. The temperature and magnetic field dependent measurements reveal a very large upper critical field (H_{c2} ~348 T). In order to study the contributions from inter and intra-granular current, we performed remanent magnetization (m_R) measurements at 5 K that showed two peaks supporting two distinct scales of current flow and inter-granular current was improved with respect to heating time. Analysis of resistivity transition broadening under various magnetic field revealed the signatures of thermally activated flux flow and the calcuated activation energy with magnetic field are discussed and compared with various heating processes.

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P-27

An Approach Towards Cancer Therapeutics With Targeted Curcumin Loaded PLGA Magnetic Nanoparticles

Balasubramanian Sivakumar, Ravindran Girija Aswathy, Yutaka Nagaoka, Yasuhiko Yoshida, Toru Maekawa and D. Sakthi Kumar

Bio Nano Electronics Research Center, Graduate School of Interdisciplinary New Science
Toyo University, Kawagoe, Saitama, 350 - 8585, Japan
E-mail: sivakbt@gmail.com, sakthi@toyo.jp

Magnetic nanoparticles (MNPs) have emerged as one of the important futuristic material for a variety of applications. The next generation magnetic nanoparticles (MNPs) with theranostic applications have attracted substantial attention and will greatly improve nanomedicine in cancer therapeutics. Advances in cancer nanotechnology increase the use of novel therapeutic strategies such as nanotheranostics, which utilize individualized diagnostic therapy. MNPs have been utilized as nanocarriers for drugs, contrast-imaging agents in magnetic resonance imaging (MRI), in local hyperthermia, and magnetic targeting. Also, in comparison to the traditional therapies of cancer like chemotherapy and radiotherapy, hyperthermia in general and MHT in particular can reduce severe side effects caused to normal tissue.

Chemotherapy is an effective option to treat cancers; however, chemotherapy is always associated with several sets of side effects. To overcome/avoid issues with side effects, natural compounds, which are used as daily food ingredients, may be an alternative option. Among many food ingredients, curcumin, a natural diphenol extracted from the ground rhizomes of Curcuma longa, possesses a number of potentially beneficial biological characteristics including anti-cancer, anti-oxidant and anti-inflammatory activities. The low bioavailability and in vivo stability of curcumin require the development of suitable carrier vehicles to deliver the molecule in a sustained manner at therapeutic levels.

Novel multifunctional MNP formulations must have ultra-low particle size, high inherent magnetic properties, effective imaging, drug targeting, and drug delivery properties. To achieve these characteristic properties, a curcumin-loaded PLGA MNP formulation was developed. The engineered structure of our formulation maintains a targeting feature, diagnostic imaging properties for MRI and optical imaging, destruction of cancer cells by the activity of curcumin and enhanced killing by hyperthermia, when an external magnetic field was applied. The dual benefits from the anticancer activity of curcumin and enhanced killing with MHT can be efficiently employed for cancer therapy.

P-28

Light-Weight, CNT-Cu Conductor With 100 Times Higher Current Carrying Capacity Than Metals

Chandramouli Subramaniam[1], Takeo Yamada[1,2], Don N. Futaba[1,2], Motoo Yumura[1,2] and Kenji Hata[1,2,3]

[1]Technology Research Association for Single Wall Carbon Nanotubes (TASC)
Central 5, 1-1-1-Higashi, Tsukuba, Ibaraki, 305-8565, Japan.
[2]National Institute of Advanced Industrial Science and Technology (AIST)
Central 5, 1-1-1- Higashi, Tsukuba, Ibaraki, 305-8565, Japan.
[3]Japan Science and Technology Agency (JST), Honcho 4-1-8
Kawaguchi 332-0012, Japan.
E-mail: kenji-hata@aist.go.jp

Here, we present a unique carbon nanotube-copper (CNT-Cu) composite possessing 100 times higher current-carrying-capacity (ampacity) than any metal, while matching the electrical conductivity of Cu. Specifically, the CNT-Cu composite has an ampacity of 6 x 10^8 A/cm^2 (Cu: 5 x 10^6 A/cm^2) and an electrical conductivity of 4.7 x 10^5 S/cm (Cu: 5.7 x 10^5 S/cm). Further, with a density of 5.2 g/cm^3 (Cu: 8.9 g/cm^3) this material is a light-weight, high-performance electrical conductor. The stand-out performance of CNT-Cu composite is clearly seen in a map of ampacity versus conductivity for all common materials. In the map, metals (Cu, Au etc.) possess high conductivity yet low ampacity while nanocarbons (nanotubes, graphene) have high ampacity and low conductivity. CNT-Cu composite occupies a singular place with both high ampacity and high conductivity.

This result assumes significance in the context of progressive miniaturization of electrical devices and gadgets, with current densities limits of Cu and Au about to be exceeded in 2014[1]. Critically important to achieve these properties was to develop a process to deposit Cu uniformly throughout the long, aligned, bulk, pre-formed Super-growth CNT structure. This was done using a two-stage nucleation-growth strategy. The large CNT-Cu interface area thus created, is vital for achieving high ampacity and conductivity.

Versatility of this strategy provides compatibility with solid-state micro-fabrication processes, enabling precise patterning of CNT-Cu into multi-dimensional, intricate geometries resembling back-end-of-line electronic circuits and interconnecting with identical electrical properties.

[1] International Technology Roadmap for Semiconductors, 2012 Ed.

P-29

Development For Compact X-Ray Source Based On Compton Scattering Using 1.3GHz Superconducting RF Accelerating Linac And New Laser Storage Cavity

Junji Urakawa[a], Masafumi Fukuda[a], Sakae Araki[a], Arpit Rawankar[b], Hirotaka Shimizu[a], Yosuke Honda[a], Kazuyuki Sakaue[c] and Nobuhiro Terunuma[a]

[a]High Energy Accelerator Research Organization (KEK), 1-1 Oho, Tsukuba, Ibaraki 305-0801, Japan
[b]Department of Accelerator Science, School of High Energy Accelerator Science, Graduate University for Advanced Studies, Shonan International Village, Hayama, Miura, Kanagawa 240-0193, Japan
[c]Research Institute for Science and Engineering, Waseda University, Shinjuku-ku, Tokyo 169-8555, Japan
E-mail: junji.urakawa@kek.jp

Main technologies related to the development of a compact high brightness X-ray source based on Compton scattering are explained and prospects for its performance described. The technologies are supported by long-term experience using an S-band photocathode RF Gun, a laser storage cavity and in generation of X-rays. Recently, we have developed a new laser storage scheme and a fiber laser amplification method to increase laser power and to reduce the laser waist size at the collision point.

P-30

Triple Targeted-Dual Drug Silica Nanoformulations For Theragnostics of Cancer And Its Associated Angiogenesis

Srivani Veeranarayanan*, Aby Cheruvathoor Poulose, Sheikh Mohamed, Saino Hanna Varghese,
Yutaka Nagaoka, Yasuhiko Yoshida, Toru Maekawa and D. Sakthi Kumar

Bio-Nano Electronics Research Centre, Graduate School of Interdisciplinary New Science
Toyo University, 2100, Kujirai, Kawagoe, Saitama 350-8585, Japan
E-mail: sriuvv@gmail.com

Engineering high-precision nanoscale therapeutic agents remains an elusive and fundamental challenge to date in the combat against cancer and various ailments. Although the biocompatibility and targeting efficacy of silica nanoparticles are promising, addressing the patho-targeting of cancer has not been elucidated yet, owing to the versatility of pathological features in cancer.

The present study was formulated to investigate the targeting efficacy of dye and dual drug load silica nanoparticles, functionalized with triple targeting ligands specifically directed towards cancer and neo-angiogenesis simultaneously. This synergized multi-target conception culminated into an elevated uptake of nanoparticles by cancer cum angiogenic cells with amplified proficiency which could be visually monitored by the accompanying fluorescent dye. The dual-drug consignment of the targeted silica nanoparticles acts on pathological cells, imparting cumulative cytotoxicity by specialized modes of action, distinct to individual drug entity.

The high precision targeting achieved with the nanoparticles is aptly complemented by the negligible toxicity rendered to normal cells. In addition, migration and angiogenic sprouting ability of activated endothelial cells were completely disabled by this nanoformulation.

The results acquired clearly present a promising and reliable option for therapeutics germane to malignancy and the related angiogenic events simultaneously leading to suppression of tumor growth.

P-31

Electrospun PVA/Chitosan Scaffolds For Wound Healing Applications

Vivekanandan. P, Sreejith. R, Yasuhiko Yoshida, Toru Maekawa and D. Sakthi Kumar

Bio-Nano Electronics Research Centre, Graduate School of Interdisciplinary New Science, Toyo University, 2100, Kujirai, Kawagoe, Saitama 350-8585, Japan
E-mail: vivekbdu@gmail.com/ sakthi@toyo.jp

FDA approved polymers; Poly (vinyl alcohol) (PVA) and chitosan were considered for this study. The two polymers were blended and spun under different parameters to obtain the scaffolds suitable for the wound healing applications.

Chitosan is used in a wide range of biomedical applications owing to their biodegradable, with hemostatic, bacteriostatic and wound healing properties (1). PVA has excellent physical, chemical and mechanical properties. It is highly biocompatible and is non-toxic; also it has high water permeability and chemical stability at room temperature is commendable. Thus, is an attractive candidate for broad practical applications in medical, cosmetic, food, pharmaceutical and packaging industries. (2). Uniform PVA/Chitosan nanofibers were produced using homogenous solutions of poly (vinyl alcohol) (PVA) and chitosan. Characterization of PVA/Chitosan nanofibers was performed using scanning electron microscope and analyzed for the cytotoxicity using mouse fibroblast cells as well as mesenchymal stem cells.

PVA/Chitosan blend when subjected to spinning produced fibers with an average diameter of 82 nm. Cytotoxic assay revealed the biocompatibility of PVA/chitosan blend.

Biocompatible polymer based nanofibers were produced for various tissue engineering applications, including wound healing. Various growth factors have to be included to increase the cellular adhesion, proliferation and migration, to show the effectiveness of PVA/chitosan scaffolds in different types of wound healings.

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Phase Transformation Behavior of Ti-Pd Based Ternary Shape Memory Alloys

R. Arockiakumar[1], H. Maheswari[1], M. Kawakita[1], M. Takahashi[2], S. Takahashi[2] and Yoko-Yamabe Mitarai[1]

[1]High Temperature Materials Unit, National Institute of Materials Science (NIMS) Tsukuba, Japan
[2]Research Laboratory, IHI Co., Yokohama, Japan
E-mail: arockiakumar@gmail.com

Ti-Pd shape memory alloys (SMA), having characteristic phase transformation temperatures 327 to 627 ºC, are potential candidates for automotive and aerospace applications. However, their high transformation temperatures and poor mechanical properties hinder them from applications. Alloying has been the common method of governing the phase transformation behavior there by characteristic temperatures and mechanical cum functional shape memory properties. The present study investigates the influence of using IVB, VB and VIB transition elements on the transformation behavior.

Addition of elements has suppressed the martensite transformation (Ms) by about 100 ºC and significantly reduced the martensite reorientation stress and increased the stress for slip deformation. Ternary alloys of Ti-Pd with Group IV elements are better among the systems investigated and exhibited up to 3.5% of shape memory strain. The phase transformation behavior, as studied by in-situ X-ray measurements up to 800 ºC, showed that alloys except with Group IV elements simultaneously precipitate Ti_2Pd_3 phase along with martensite to austenite transformation. This is believed to be the reason for the poor shape recovery behavior of Ti-Pd alloys with Group V and IV elements.

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Biocompatible Extremophilic Bacterial Polysaccharide Based Nanofibers For Tissue Engineering Applications

Sreejith Raveendran,* Brahatheeswaran. D, Yasuhiko Yoshida,
Toru Maekawa and D. Sakthi Kumar
Bio-Nano Electronics Research Centre, Grad. School of Interdisciplinary New Science
Toyo University, 2100, Kujirai, Kawagoe, Saitama 350-8585, Japan
E-mail: sreejithr84@gmail.com/ sakthi@toyo.jp

Extraction of extremophilic bacterial polysaccharide, mauran from *Halomonas maura* for the synthesis of nanofibers after blending with PVA using electrospinning for tissue engineering applications.

Extremophilic bacterial polysaccharide based biocompatible nanofibers were produced for the first time via electrospinning technique. Mauran as a biologically compatible polymer can be used for the synthesis of novel nanoparticles for cancer therapy, drug delivery and bio-imaging applications [1, 2]. Thin- uniform MR nanofibers were produced using homogenous solutions of poly (vinyl alcohol) (PVA) blended with different concentrations MR. Characterization of complex MR/PVA nanofibers were performed using scanning electron microscope and analyzed for the cytotoxicity using mouse fibroblast cells as well as mesenchymal stem cells.

An average of 120 nm sized nanofibers were produced and tested for an enhanced cell growth under *in vitro* conditions in comparison with control. MR and MR/PVA nanofibers were found to be an excellent biomaterial for the migration, proliferation and differentiation of mesenchymal stem cells and fibroblast cells. Interestingly, biological and physicochemical properties of MR hasten the application of MR based nanofibers for various biomedical applications like tissue engineering and drug delivery.

Non-cytotoxic bacterial polysaccharide based nanofibers were produced for the first time for tissue engineering applications to best of our knowledge.

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Local Order at Zn/Gd-enriched Stacking Faults in a $Mg_{97}Zn_1Gd_2$ Alloy

Kosuke Kawaguchi[1], Daisuke Egusa[1], Michiaki Yamasaki[2],
Yoshihito Kawamura[2], Eiji Abe[1]

[1]*Department of Materials Science and Engineering, University of Tokyo, 7-3-1, Hongou, Tokyo 113-8656, Japan*
[2]*Department of Materials Science, Kumamoto University, 2-39-1, Kurokami, Kumamoto, 860-855, Japan*
E-mail: kawaguchi@stem.t.u-tokyo.ac.jp

Mg-Zn-Gd alloy forms synchronized long-period stacking ordered (LPSO) phases. When the $Mg_{97}Zn_1Gd_2$ alloy is annealed at relatively low temperatures, a high density of stacking faults (SF) are formed [1] as to alternate with the LPSO phase. Atomic resolution high-angle annular dark-field scanning transmission electron microscopy (HAADF-STEM) observations revealed that solute elements of Zn and Gd are significantly concentrated at the SF [1]. However, the ordered arrangement of solute elements in the SF is not fully understood. In this study, we investigate the Zn/Gd ordered arrangement in the SF by HAADF-STEM observations, and discuss in relation with the local Zn/RE order in the ideal LPSO structures [1].

The nominal composition of the alloy used in this study is $Mg_{97}Zn_1Gd_2$ (at.%). Ingots were prepared by high frequency induction heating in an argon atmosphere. Solution treatment was carried out at 793 K for 2 h in air, and then specimens were annealed at 573 K for 10 h, 673 K for 15min and 773 K for 15 min, respectively. A high-density SFs can be formed in these annealing conditions [1]. The microstructure of the alloy was investigated by TEM with a conventional microscope (JEM-2010HC) and HAADF-STEM images with a conventional 200keV microscope (JEM-2010F) and an aberration-corrected 200keV microscope (JEM-ARM200F).

Experimental results of the HAADF-STEM images of the 14H-LPSO and SF formed in the $Mg_{97}Zn_1Gd_2$ alloy annealed 573 K for 10 h show that there is the distinct Z-contrast representing Gd/Zn order in the LPSO structure, as similar to that observed for the Mg-Zn-Y LPSO phase [2]. Similar local Z-contrast is also confirmed in the Gd/Zn enriched SF layers, indicating similar local Gd/Zn arrangements indeed occur at the SF. These results indicate that SF area could be an effective precursor to the LPSO phase.

Reference

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Reduction of shear localization by high-pressure torsion in $ZR_{50}CU_{40}AL_{10}$ bulk metallic glass

Fanqiang Meng[1,2], Koichi Tsuchiya[1,2], Yoshihiko Yokoyama[3]

[1]*Microstructure Design Group, National Institute for Materials Science, Sengen, Tsukuba, Ibaraki, 305-0047, Japan*
[2]*Graduate School of Pure and Applied Sciences, University of Tsukuba, Tsukuba, Ibaraki, 305-8577, Japan*
[3]*Institute for Materials Research, Tohoku University, Sendai, Miyagi 980-8577, Japan*
E-mail: meng.fanqiang@nims.go.jp

Bulk metallic glasses (BMGs) have attracted extensive attention because of the basic science and potential engineering application of the materials. This class of materials exhibits unique mechanical properties, e.g. high strength, high elastic limit, and bending ductility [1]. Plastic deformation of BMGs at room temperature highly localizes into shear bands, resulting in poor ductility under tension. Introduction of structural heterogeneity by high-pressure torsion (HPT) is regarded as potential method to improve the ductility of BMGs *via* reducing the shear localization. In the present study, nanoindentation is used to probe the details of serrated flow behavior in casted and HPT deformed $Zr_{50}Cu_{40}Al_{10}$ BMG.
The disc of $Zr_{50}Cu_{40}Al_{10}$ was subjected to HPT deformation under applied pressure of 5 GPa and rotation speed 1 r.p.m. for 50 revolutions. Thermal analysis and microstructural observations were carried out by Differential scanning calorimetry (DSC), scanning electron microscopy (SEM) and transmission electron microscopy (TEM). Mechanical performance was evaluated by microhardness and nanoindentation.

The presence of same glass transition temperature and absence of crystallization indicated the character of amorphous structure after HPT deformation. Mechanical testing revealed that both hardness and elastic modulus were remarkably reduced by deformation, associating with the decrease in the number of serrations, which are attributed to the nucleation and propagation of shear bands. Observations on the indented area proved the decrease in the number of shear bands by HPT, consistent with the decrease in serrations. In addition, the serrations in both casted and HPT deformed samples exhibited dependence on the loading rates: slower loading conditions appear to promote serrations over a wider range of depth, but higher loading rates reduced or suppressed them.

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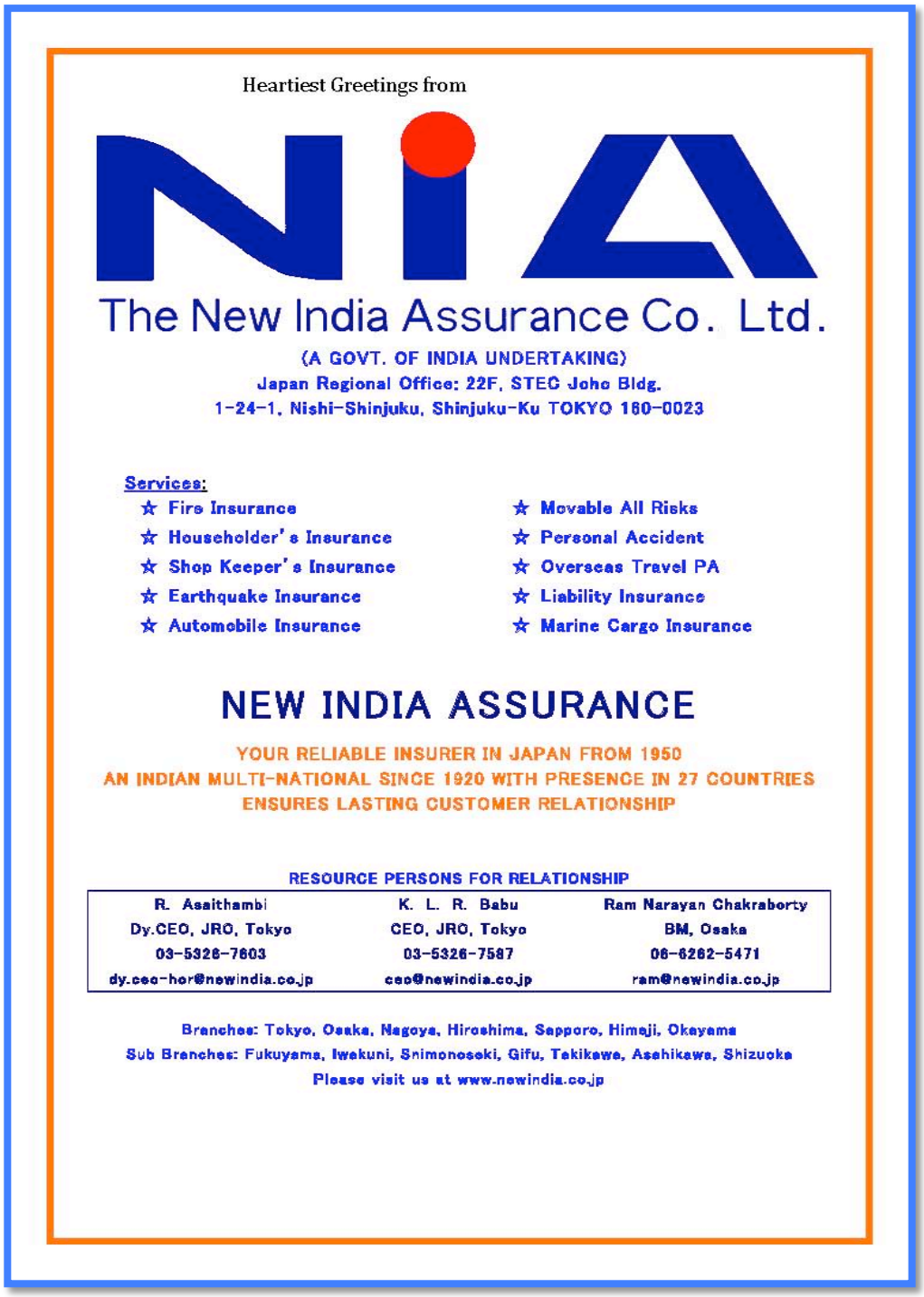

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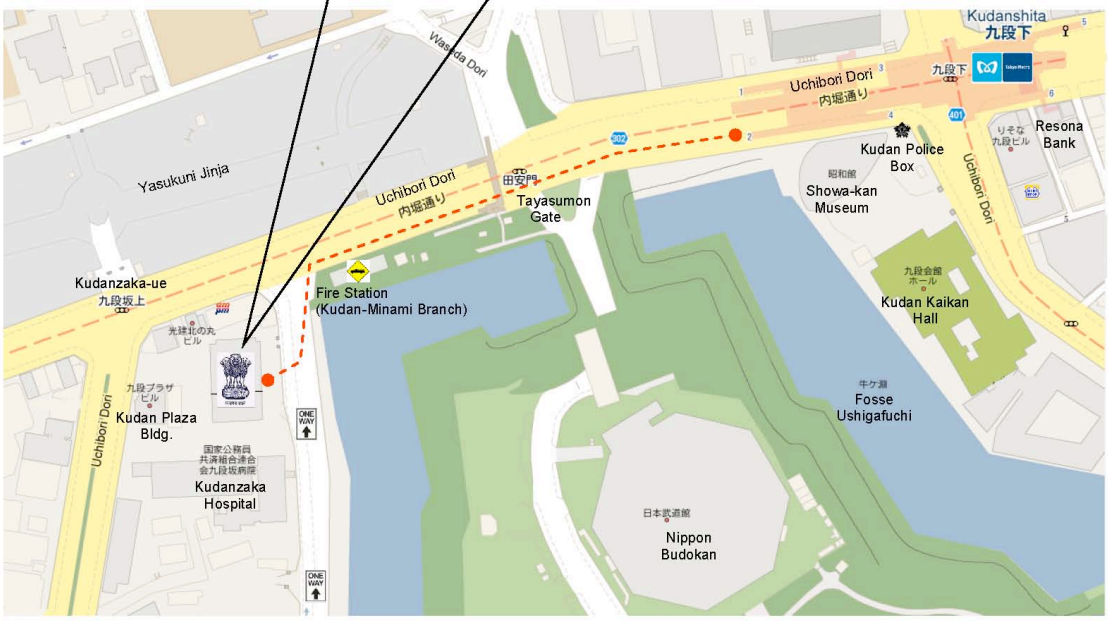

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Notes