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President's Message



Ashok Misra, President of FAPS
Intellectual Ventures, Bangalore, India
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The establishment of the Federation of Asian Polymer Societies was a landmark event in 2007 due to the bold initiative taken by Prof. Jung-Il Jin, its Founder President. FAPS has brought leading researchers from various Asian countries to a common forum to deliberate on cutting edge research going on in Asia in the important area of Polymers and address issues that are more relevant to the our countries. Japan, South Korea, China and India were the four founding countries that started this movement and I was fortunate to be a Founding member of the FAPS Council. I fondly remember attending the first FAPS Congress held at Nagoya in Japan and the excitement that it created for all of us to have our very own special Asian entity. Since then three Polymer Congresses have been held – in China, India and, most recently in Malaysia. We were privileged to hold the third Congress in Bangalore; an outstanding Polymer conference with very active participation by foreign and Indian Scientists. Such events provide an excellent platform for the students and young researchers as they get a chance to interaction with the best in the world, especially in the Asian region. I have been fortunate to be the President of FAPS from 2013 to 2015 and to contribute to the FAPS movement.

Polymerization is perhaps the greatest contribution of Chemistry in the 20th century, which led to the development of a wide variety of polymers over the last 60 odd years with applications in a many diverse areas ranging

from the relatively inexpensive commodity plastics to the advanced composites and specialty polymers. All this has been possible due to the exciting research work done by polymer scientists all over the world. Asian scientists have made a very significant contribution in this journey and will continue to do so. I see FAPS as an international body for sharing innovative scientific research and develop ideas that will enhance Asia's role in finding solution for global issues. As we move forward, FAPS should continue to address the needs of mankind as well as address the issues of sustainability. The polymer industry world-over is very vibrant and the products that they have produced have had a major impact on the lives of people. Further, the polymer industry in the Asian countries has contributed very significantly to the production of polymeric materials and I see this enhancing in the future. These are turbulent times for the economy, which also provides an opportunity for new developments. I have been impressed with the entrepreneurs in polymer related areas who are constantly innovating. We need to enhance our interaction with the polymer industry for mutual benefit.

I wish FAPS all success in our future endeavours and make its presence felt globally.

(Ashok Misra)
President, FAPS

Welcome Remarks



Jung-II Jin, President
Korea University, Seoul, Korea
jijin@korea.ac.kr

The founding of the Federation of Asian Polymer Societies (FAPS) goes back to the summer of 2006 when the Asian Polymer Symposium (APOSYM) was held in Seoul.

Cognizant of the fact that in Asian countries many small conferences had been held in polymer science and engineering, it was proposed during the Seoul APOSYM reception that FAPS should be established in order to offer a broader forum for Asian polymer scientists. This suggestion was enthusiastically accepted by all the participants.

The representatives from China (Fosong Wang; Beijing), Japan (Hiroyuki Nishide; Tokyo), and Korea (Jung-II Jin; Seoul) got together in October 2007, at Jeju, Korea and agreed to initiate the foundation of FAPS. At the request by Japan, it was also agreed that India (Ashok Misra; Bombay) would be invited to join the group of founding members.

After numerous discussions the Constitution of FAPS was finalized in December 2007 and FAPS came into being on January 1, 2008. Being the proposer, I was elected to be the founding President (2008-2009), Professor Hiroyuki Nishide, Vice President and President-Elect (2010-2011), Professor Jungahn Kim (Kyung Hee University, Seoul, Korea) Secretary-General, and Hiroyuki Ohno (Waseda University, Tokyo, Japan), Treasurer. Professor Dong-Hoon Choi (Korea University, Seoul, Korea) and Dr. Takashi Mihara (The

Society of Polymer Science, Japan) were appointed as Secretaries.

Till now fourteen countries have joined FAPS and they are Bangladesh, China/Beijing, China/Taipei, India, Indonesia, Japan, Korea, Malaysia, Nepal, Pakistan, Russia, Singapore, Thailand, and Vietnam. The Asian part of Russia (Prof. Yury Shchipunov, Vladivostok) has also expressed their desire to join FAPS. There are still many Asian countries who have expressed interest to join FAPS. We are very excited by the enthusiastic reception from the Asian polymer community.

Since its founding, FAPS has held four congresses, at Nagoya, Japan (2009), Beijing, China (2011), Bangalore, India (2013) and Kuala Lumpur, Malaysia (2015). FAPS is also an associate member of the International Union of Pure and Applied Chemistry (IUPAC).

I am very happy to greet you with this fifth issue of the Federation newsletter and would like to thank Professors Sivaram and Ramakrishnan for helping in the preparation of this newsletter.

I wish all the best to the FAPS members and member societies.

Jung-II Jin

FAPS Membership Countries

Country	Society Name	Member (E-mail)
China/ Beijing*	The Polymer Division of the Chinese Chemical Society	Prof. Zi-chen Li [zcli@pku.edu.cn]
India*	The Society of Polymer Science, India	Prof. S. Ramakrishnan [raman@ipc.iisc.ernet.in]
Japan*	Society of Polymer Science, Japan	Prof. A. Takahara [nishide@waseda.jp]
Korea*	Polymer Society of Korea	Prof. Jungahn Kim [jakim05@khu.ac.kr]
Bangladesh	Bangladesh Chemistry Society	Prof. Md. Abul Hashem [bchemsoc@bangla.net]
China/ Taipei	The Polymer Society, Taipei	Dr. Jen-Lien Lin [JLLin@itri.org.tw]
Indonesia	Indonesian Polymer Association	Dr. Agus Haryono [agus.haryono@lipi.go.id; haryonolipi@yahoo.com]
Malaysia	Institute Kimia Malaysia (Malaysian Institute of Chemistry)	Datuk Dr Soon Ting-Kueh [soontk@ikm.org.my]
Nepal	Nepal Chemical Society	Dr. Rameshwar Adhikari [nepchemsoc@yahoo.com]
Pakistan	Chemical Society of Pakistan	Dr. Khalid M. Khan [khalid.khan@iccs.edu]
Russia	Polymer Council of Russia, Academy of Sciences	Prof. Alex Khokhlov [khokhlov@polly.phys.msu.ru]
Singapore	The Plastics and Rubber Institute of Singapore	Prof. Hu Xiao [ASXHU@ntu.edu.sg]
Thailand	Polymer Society of Thailand	Dr. Krisda Suchiva [krisdasc@mtec.or.th]
Uzbekistan	Institute of Nuclear Physics, Department of Composite Materials	Prof. Ulmas Gafurov [ulmas3@mail.ccc.uz]
Vietnam	Polymer Society of Vietnam	Prof. Nguyen DucNghia [ducnghia264@pft.vn]

Founding Member*

Report on the 3rd FAPS Congress 2013



The inauguration

The 3rd FAPS Polymer Congress was held at the Indian Institute of Science, Bangalore during May 15-18, 2013. This meeting was jointly organized along with the biannual conference (MACRO) of the Society of Polymer Science-India (SPSI) and hence was coined FAPS-MACRO 2013. The biannual conference organized by SPSI is one of the most important National conferences on Polymer Science and attracts a large number of leading researchers from India and abroad. The joint FAPS-MACRO 2013 event, likewise attracted several excellent researchers from across the world; in addition to several leaders from Asia and India. The total registered participants at the FAPS-MACRO 2013 were ~550; they came from over 17 countries. Importantly, about 330 participants were PhD students; a special effort was made to attract students by providing them a highly subsidized registration fee, thanks to the generous sponsorship from major chemical industries. One highlight of the meeting was the emphasis on the poster sessions; about 250 posters were exhibited during two 150-minute poster sessions.

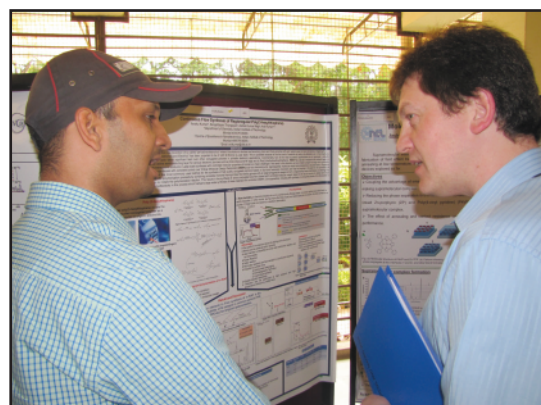
The Congress began with a brief inaugural session that witnessed welcome addresses by the Director of the Indian Institute of Science, Professor P. Balaram; SPSI President, Dr S. Sivaram; Chairman of FAPS-MACRO-2013, Professor Ashok Misra; and Professor Zi-Chen Li, on behalf of the FAPS, President, Professor Fosong Wang. This was followed by the first Plenary talk by Professor Eiji Yashima from Nagoya University, who delivered a fascinating account of mimicking the beautiful and complex structures adopted by biomacromolecules in synthetic polymers. The congress had 8 parallel sessions covering sessions covering all important areas of contemporary Polymer Science, which followed the Plenary talks on each day; the parallel sessions were on the following topics:

1. Tailored polymeric structures
2. Block copolymers and nanostructured films
3. Conjugated polymers and device applications
4. Polymer Physics - Structure and Dynamics
5. Polymeric gels and soft structures
6. Polymer Processing
7. Polymeric biomaterials
8. Blends and nanocomposites

Typically, three to four of these sessions ran in parallel and witnessed several exciting Invited and Oral presentations. Two poster sessions were held during the early evenings



Professor Eiji Yashima



between 3:45 to 6:00 PM, on the first and second days. Day one ended with a delightful cultural program by one of the leading flautists of the local region (Karnataka), Mr Pravin Godkindi.

The second day began with two excellent Plenary talks; one by Professor M. Muthukumar from UMass, Amherst (USA) and the other by Professor Chris Ober from Cornell University (USA). Muthukumar enthralled the audience with his exposition on the theoretical foundations for understanding polymer crystallization, while Ober gave a fascinating



Godkindi and his team

account of the recent exciting developments in the area lithography and the challenges that lay ahead. A special evening lecture, that provided an industry perspective, was delivered by one of the leaders of the Indian chemical industry, Dr Surendra Kulkarni, Head of Research and Development at SABIC-India; this was followed by a Banquet dinner.

On day three, the participants were treated to two more Plenary lectures; one by Professor Mitsuru Akashi from Osaka University was on applications of layer-by-layer assembled polymeric systems and the other by Dr Ashish Lele from



Professor M. Muthukumar

National Chemical Laboratory, Pune (India) on Smart Polymer Gels.

On the final day, there were three Plenary talks; the first one by Professor Soo-Young Park from Seoul National University was on Self-assembled Fluorescent Materials, the second by Professor Julie Kornfield from Caltech (USA) on a fascinating topic of light-adjustable polymeric elastomers for ophthalmological applications, and the last Plenary talk was by Professor Jin Kon Kim from Pohang University (Korea) on Block Copolymer Self-assemblies. The meeting ended with rapid-fire poster presentations by a few selected posters that were chosen by a committee; 9 best poster prizes were awarded.



Professor Mitsuru Akashi



Professor Julie Kornfield



Winners of the Best Poster Prize

6th FAPS Council Meeting



FAPS Council meeting in progress



Kim, Jin and Li

The 6th FAPS Council meeting was held on May 16, 2013 in Bangalore. The meeting was attended by Prof. Jung-Il Jin (Republic of Korea), Prof. Jungahn Kim (Republic of Korea), Prof. Zi-Chen Li (China), Prof. Hiroyuki Nishide (Japan), Prof. Ashok Misra (India), Prof. S. Sivaram (India), Prof. S. Ramakrishnan (India), Prof. Rusli Daik (Malaysia), Prof. Chin Han Chan (Malaysia), Prof. R. Adhikari (Nepal), Prof. Jiun-Tai Chen (Taiwan). The salient points emanating from the discussions were: a) the finalization of the dates and venue for the 7th FAPS Polymer Congress, which is to be held in Malaysia, about which a presentation was made by Prof Rusli Daik; b) IUPAC membership needs to be maintained, which would be the responsibility of the country holding the Presidentship; c) the Newsletter needs to be brought out on schedule and the FAPS webpage needs to be updated and maintained; d) India, having hosted the 6th FAPS Polymer Congress, would hold the Presidentship for the years 2013-2015 and Prof. Ashok Misra was requested to take over the Presidentship and Prof. S. Ramakrishnan would serve as the Secretary General; Dr S. Sivaram, as the current President of SPSI was requested to serve as an Honorary Advisor; e) Prof. Rusli Daik was inducted into the Council as the hosting country of the 7th FAPS Congress; and f) it was confirmed that Korea would host the 8th FAPS Polymer Congress in 2017.

Report on the FAPS Mini Symposium, October 30-31, 2014

The Society for the Polymer Science, India, Pune Chapter organized a one and half day International Meet on Advances in Polymer Science on October 30-31, 2014, at CSIR-National Chemical Laboratory, Pune, India. On this occasion, the Council of the Federation of Asian Polymer Societies (FAPS) also met at Pune.

The following eminent scientists attended the meeting:

Prof. Ashok Misra, Intellectual Ventures, Bangalore
 Dr. S. Sivaram, CSIR-National Chemical Laboratory, Pune
 Prof. Hiroyuki Nishide, Waseda University, Tokyo, Japan
 Prof. Jung-Il Jin, Korea University, Seoul, South Korea
 Prof. S. Ramakrishnan, IISc, Bangalore
 Prof. Jungahn Kim, Kyung Hee University, Seoul, South Korea
 Prof. Atsushi Takahara, Kyushu University, Fukuoka, Japan
 Dr. A. J. Varma, CSIR-National Chemical Laboratory, Pune
 Prof. Rusli Daik, Universiti Kebangsaan, Selangor, Malaysia
 Prof. Atsushi Suzuki, Yokohama National University, Yokohama, Japan.

Prof. Zi-Chen Li, Peking University, Beijing, China had to drop out of the meeting due to non-receipt of visa.

The Meet brought together a large number of active Indian scientists and those from overseas for two days of intense deliberations.



Welcome address by Dr. Sourav Pal, Director, CSIR-National Chemical laboratory, Pune, and the Introductory remarks by Dr. S. Sivaram, President, SPSI and Dr. Ashok Misra, Member of the FAPS Council Intellectual Ventures, Bangalore.

The First Technical Session

Chairman: Professor Ashok Misra



**Professor Hiroyuki Nishide,
Waseda University, Tokyo, Japan**



Redox Polymers for Soft Energy Devices

Professor Nishide's lecture focused on aliphatic polymers bearing redox-active groups per repeating unit. The redox polymers are characterized by an ultimate population of the electron-releasing and -gaining site that allows efficient redox-driven electron- or charge-transport and -storage throughout the polymer layers via self-exchange reactions. Challenges toward paper-like and bendable rechargeable batteries by molecular designing of the redox polymers will be demonstrated. We are also fabricating dye- sensitized photovoltaic cells with the redox polymer layers for charge-separation and -transport in the cell. The cells are being tested as a cord-less power source assisted with interior lighting. Another example is anode-active redox polymers, such as a quinone polymer, which reversibly formed their hydrogen additives such as a hydroquinone polymer. The redox polymer resins are being examined as a new-type hydrogen carrier, of which advantages are non-explosive, non-leakage, safety transportation, storage, and facile evolution of hydrogen. Redox polymers are emerging as a new class of organic materials for energy-saving devices.

Professor Jung-Il Jin,
Korea University, Seoul, South Korea



Material Science of DNA: Optical Properties of Natural and Modified DNAs

This presentation discussed optical, electro-optic, and optoelectronic properties of natural and chemically modified DNA. Natural DNAs are water soluble. However, if the sodium ions of natural DNA molecules are replaced with long alkyl onium ions, the resulting modified DNAs (QDNAs) become soluble in common organic solvents and produce high optical quality films. The natural and QDNAs, when they are in the form of double helix, commonly absorb at about 260 nm, which is the result of electronic transitions of nucleic bases. Moreover, QDNAs reveal practically the same CD spectra as the natural DNA, which is taken as a strong indication that replacement of Na^+ ions with onium(Q^+) ions does not destroy the original double helical structure. Fluorescence behavior of DNAs themselves and DNA mixtures with conventional fluorescence dyes is very interesting. Especially, DNAs modified to bear various fluorophores in the Q^+ -part can be utilized in tuning luminescence colors. DNA-based lasing provides us with a new approach to develop organic compositions. In addition, light-emitting diodes based on DNA, photovoltaics of DNA containing solar cells, and nonlinear optical compositions of modified DNAs are some of the opportunities emerging from this study. DNAs may not be the ideal materials for various applications, but the science we learn from DNAs appears to be very important in expanding the horizon of materials science.

The Second Technical Session

Chairman: Professor S. Ramakrishnan



**Professor Jungahn Kim,
Kyung Hee University,
Seoul , Korea**



Living Anionic Ring-opening polymerisation of Ethylene oxide and Its Chain-end Functionalizations
Poly(ethylene glycol) (PEG) has received a great attention in the biomedical field because of its low level of cell and protein adsorption. In this respect, PEG must be an important material for modification of proteins, synthesis of drug-conjugates, and preparation of nano-carriers in the drug delivery system. However, it is not simple to get well-defined PEG with controlling molecular weight and carrying functional groups at the chain-end. Up to date, the best method to synthesize PEG with well-defined structure has been known to be living anionic ring-opening polymerization of ethylene oxide leading to generation of poly(ethylene oxide) (PEO) showing the same chemical structure as that of PEG. The lecture described approaches to living polymerization of ethylene oxide. Especially, it is expected that the synthesis of heterobifunctional polymers can be readily achieved by ring-opening polymerization of EO using functional initiator and chain-end functionalization of the resulting polymeric alkoxides.

**Professor Atsushi Takahara,
Kyushu University,
Nishi-ku, Fukuoka, Japan**



Precise Design of Antifouling, Lubrication and Intelligent Adhesion Surfaces through Polyelectrolyte Brush Immobilization

Surfaces and interfaces of soft materials play an important role in various functional applications. Polyelectrolyte brushes provide soft interfaces with unique functionality. However, systematic studies on the structure and functionality of polyelectrolyte brushes at liquid interfaces have not been done yet. Various polyelectrolyte brushes with anionic, cationic, and zwitter ionic side chains were prepared on initiator immobilized Si-wafer and macroinitiator-modified polypropylene by surface-initiated atom transfer radical polymerization (SI-ATRP). Surface wettability and chain conformation of polymer brushes at water/solid interfaces were characterized by contact angle measurement and neutron reflectivity, respectively. Super hydrophilic surfaces, antifouling surfaces, environmentally friendly water lubrication systems, and repeatable environmentally friendly adhesion systems without organic solvents were realized through polyelectrolyte brushes immobilization.

Third Technical Session

Chairman: Dr. A.J. Varma



**Professor Rusli Daik, Universiti Kebangsaan Malaysia,
UKMM Bangi, Selangor**



Enzymatic Polymerization of Monomer Derived from Oil Palm Empty Fruit Bunch

Oil palm empty fruit bunch fiber (OPEFB) is a lignocellulosic waste from palm oil mills. It is a potential source of glucose and xylose which can be used as raw materials for high value products such as succinic acid. The interest on use of lignocellulosic waste for bioconversion to fuels and chemicals is increasing as these materials are relatively low cost and renewable. The objective of the present study is to produce biodegradable polyesters from OPEFB-derived monomer via enzymatic polymerization. Cellulose and glucose were used as intermediates to produce succinic acid. Organosolv pretreatment was used to extract cellulose from OPEFB. The solvents used were mixtures of ethanol and water. Batch enzymatic hydrolysis of OPEFB cellulose was performed at 40°C using celluclast and Novozyme 188. The highest glucose concentration produced is 167.4 g/L (sugar recovery is 0.73 g/g from OPEFB). Fermentation using *Actinobacillus Succinogenes* was carried out on glucose to produce succinic acid with highest conversion of 26 %. Enzymatic polymerization was carried out on the succinic acid that was produced from OPEFB with the presence of 1,4-butanediol, glycerol, or ethylene glycol to form biodegradable polyesters using Lipase (*Candida Antartica* CALB) as a catalyst. Molecular weight for the obtained poly(butylene succinate), poly(glyceryn succinate), and poly(ethylene succinate) were 5.90×10^4 , 6.20×10^4 and 4.53×10^4 g/mol, respectively. For the characterization of cellulose, succinic acid and polyesters, Thermogravimetric Analysis (TGA), Fourier Transform Infrared (FTIR) Spectroscopy, Nuclear Magnetic

Resonance (NMR) Spectroscopy, Differential Scanning Calorimetry (DSC) and Field Emission Scanning Electron Microscope (FESEM) were used. High Performance Liquid Chromatography (HPLC) and Gel Permeation Chromatography (GPC) were used to determine the quantity of glucose and succinic acid produced, and to measure the molecular weight of biodegradable polyesters. Polyesters with degree of polymerization of more than 100 were achieved. Degradation of about 80% can be achieved after polyesters being exposed to lipozyme for 3 days.

Professor Atsushi Suzuki,
Yokohama National University,
Yokohama, Japan



Hybrid Poly(vinyl alcohol) Hydrogels for Artificial Cartilage on Bionic Design

There have been attempts to develop artificial cartilage made of soft materials with super lubricity based on a bionic design by elucidating the lubrication mechanisms of natural synovial joints. Among the soft materials, poly(vinyl alcohol) (PVA) gel is one of the most-often-studied hydrogels for such applications. Some PVA gels show a low coefficient of friction under specific conditions and high water content comparable to natural articular cartilage. For example, it was reported that PVA gels prepared by a freeze–thawing method (FT gel) show a very low friction coefficient under walking conditions lubricated with hyaluronate solution containing protein. A simple method to prepare a physically crosslinked PVA gel by a cast-drying method (CD gel), which was recently reported, is also promising. For the application of hydrogels as artificial articular cartilage, there are several essential properties required, such as biocompatibility, low friction, high wear resistance, suitable water content, and high mechanical strength (i.e., stiffness, fracture toughness, and fatigue resistance). The CD and FT gels both have high water absorbance and excellent mechanical properties as compared with other hydrogels. However, the mechanical strength of each gel is not enough to be of practical use, and FT or CD gel alone cannot satisfy all required properties. Of the required properties, the mechanical strength and wear resistance of these gels are not enough as compared with natural synovial joints and further improvements are needed for practical uses. As candidates for practical use as artificial cartilage, new methods of preparing PVA hydrogels have been studied, such as combining different types of PVA gels with different structures, elastic moduli, and characteristics of permeability. A lamination method and hybrid techniques using FT and CD gels were examined in order to improve the mechanical and tribological properties.

The organizing Committee of the Meeting wishes to acknowledge the support of CSIR-NCL which provided an excellent ambience and all logistic support. An event of this kind could not have been organized without the generous financial support from sponsors. FAPS-SPSI wishes to place on record their gratitude for the generous financial support to this event from M/s Reliance Industries, Mumbai. M/s AdilabTech, Pune and M/s Sinsil International, Pune also provided financial support to the organization of this event.



Announcements

The 5th FAPS Polymer Congress (FAPS-PC2017)

Conference Date: October 13-17, 2017

Conference Venue: Jeju Island, Korea

Organizing Committee

Chair: Dr. Jungahn Kim (jakim05@khu.ac.kr)

FAPS Council Members :

Jung-Il JIN (Korea); Jungahn KIM (Korea)

Zi-Chen LI (China); S. Sivaram, (India)

Hiroyuki NISHIDE (Japan); Hiroyuki OHNO (Japan)

S. Ramakrishnan (India); Fosong WANG (China)

The 6th FAPS Polymer Congress (FAPS-PC2019)

Conference Date: November 11-14, 2019

Conference Venue: Kenting, Taiwan

Organizing Committee

Chair: Professor D-J Liaw (liawdj@gmail.com)

THE 4TH FEDERATION OF ASIAN POLYMER SOCIETIES INTERNATIONAL POLYMER CONGRESS

4FAPS-IPC 2015

**“Functional Polymers – Advanced Materials
for the Future”**

**October 5 – 8, 2015
Kuala Lumpur, Malaysia**



**Organised by:
Institut Kimia Malaysia
(IKM)**



**Under the auspices of:
Federation of Asian Polymer
Societies (FAPS)**



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