Volume 13, Issue 1

January 2013

Polymer News

A newsletter of the Society of Polymer Science, India, Thiruvananthapuram Chapter

Dr. A Ajayaghosh.... and molecular assemblies that respond

This year's formation day lecture is delivered by Dr. A. Ajayaghosh, recipient of the prestigious Infosys Prize for Physical Sciences –2012. Given below is a brief summary of his outstanding contributions.

Dr. Ajayaghosh has made significant original contributions to the fundamental understanding of the self-assembly of short linear pi-systems and fluorescent dyes. Since these type of molecules are widely used in organic electronic devices, a deeper understanding of their self interaction as well as interaction with other substrates is essential for optimizing the device performances. The focus of these studies is to understand the way molecules self-organize to form diverse architectures and how the nature of self-assembly influences upon physical properties, effectively utilizing various non-covalent interactions. This fundamental understanding of molecular interactions helps scientists design new soft functional materials based on self-assembly approach which is useful for applications in sensing, imaging, security labeling etc. Even though Dr. Ajayaghosh has made significant contributions in different areas of chemistry, the present nomination is for his contributions to the study of fluorescent molecules and assemblies with diverse

Contd. in Page 2

From the President's Desk...

2012 was a gratifying year for polymer community as a whole. The world observed a lot of innovation in the field of polymers. Polymers continued their victory march in the fields of space, biomedical, smart, nanotechnology, solar energy etc. The year was eventful for SPSI too that it could organize a good number of seminars including those for students. The overwhelming response of the student community motivates us to carry the torch further. This year, SPSI Thiruvananthapuram Chapter was specially honored when its Vice President Dr. Ajayaghosh was conferred with the prestigious Infosys Prize for physical sciences for 2012 . Many of our members also received honors in their professional fields. Smt. Smitha C. Sukumaran, Smt. Bismi Bhasheer, Shri Biju R and Dr. S Mahesh are a few among them. While congratulating them I wish all members many laurels in the new year. The Chapter also bids fare to its former President, Prof. (Dr.) A Jayakrishnan who demitted the office of the Vice Chancellor, University of Kerala. The services rendered by him to the Society are gratefully acknowledged.

The New Year poses greater technical and social challenges to the polymer community. The major concern is the plastic waste that haunts all of us. Switching over to biodegradable plastics is not the ultimate solution for the problem as we bank on the non-biodegradability of polymers for many applications. Avoiding indiscriminative use of plastic materials is the only way out. Polymer technologists have

a lot to do to make our life more comfortable than it is. Let us all work towards this goal in the New Year, while keeping the environment green.

I wish all members a wonderful year 2013

(Dr. C.P Reghunadhan Nair
Group Director, PSCG, VSSC, Trivandrum and President, SPSI Thiruvananthapuram Chapter)

Notice

- AGM is on Saturday, 19th January 2013 , 6:00 pm at Hotel Pankaj, Statue, Thiruvananthapuram.
- SPSI Best Ph.D Paper award presentation on AGM day.
- Formation Day Lecture is given by Dr.A Ajayaghosh, CSIR-Outstanding Scientist, Chemical Sciences and Technology Division, National Institute for Interdisciplinary Science and Technology (NIIST) , Trivandrum. Dr.Ajayaghosh is the winner of the prestigious Infosys prize for physical sciences for the year 2012.

In this issue:

Editors

Dr. R.S. Rajeev, VSSC

Dr. C. P. Reghunadhan Nair, VSSC

Dr. A Ajayaghosh......(contd. from Page 1)

shape, size and properties, as color tunable fluorescent materials useful applications in sensing, imaging, security labeling and diagnostics. The significant contributions are highlighted here:

Dr. Ajayaghosh has established the importance of cooperative involvement of H-bonding and p–stacking interactions towards the design of a new type of self-assembled soft materials called p –gels using fluorescent linear p–systems (**JACS 2001, 123, 5148; Chem.-Eur. J. 2005, 11, 3217**). This is one of the first reports on an organogel derived from a linear p–system which encouraged the scientific community to work on similar systems. Subsequently, several strategies were formulated to control the size and shape of these self-assemblies. Examples include helical architectures of single handedness (**Angew. Chem., Int. Ed. 2004, 43, 3422; Angew. Chem., Int. Ed. 2006, 45, 1141),** twisted and coiled structures (**Angew. Chem., Int. Ed. 2006, 45, 456**), vesicles, and tubules, (**Angew. Chem., Int. Ed. 2006, 45, 3261; Angew. Chem. Int. Ed. 2006, 45, 7729**). By varying the size and shape of these assemblies, significant control on the optical and electronic properties could be achieved.

The self-assembled materials developed by Dr. Ajayaghosh have been utilized as a soft scaffold for selective energy transfer – a key step in efficient light harvesting process (**Angew. Chem., Int. Ed. 2003, 42, 332; JACS 2006, 128, 7174; JACS 2006, 128, 7542; Angew. Chem., Int. Ed. 2007, 46, 6260**). The important results of these studies are summarized in two recent articles (**Acc. Chem. Res. 2007, 40, 644; Chem. Soc. Rev. 2008, 37, 109**). One of the exciting recent results is the rational control of self-assembly for the modulation of the energy transfer processes and the simultaneous generation of RGB colors resulting in white light emission (**Adv. Mater. 2009, 21, 2059, patent application – PCT/IN08/00372 (Pub. No. WO/2009/084006**). Using the principles of molecular self-assembly, Ajayaghosh and coworkers could develop a superhydrophobic material that mimics the self-cleaning property of lotus leaf (**Angew. Chem., Int. Ed. 2008, 47, 5750; patent application: PCT/IN08/00538 (Pub. No. WO/2009/037717**). Another application of the soft self-assemblies developed by Ajayaghosh has relevance in secret document writing (**JACS, 2009, 131, 15122; patent applied**). Recently, Dr. Ajayaghosh and his research team demonstrated the importance molecular self-assembly to the design of organogels with high charge carrier mobility and metallic conductivity (**JACS, 2010, 132, 8866; JACS, 2010, 132, 13206**). Such self-assembled structures are expected to have application in design of self-assembly based bulk hetero-junction solar cells which is a topic of great importance in the field of sustainable energy generation (**Angew. Chem., Int. Ed. 2012, 51, 1766**).

Many of the fluorescent molecules designed by Ajayaghosh's research group are useful as probes for the selective sensing of biologically relevant cations (**Angew. Chem., Int. Ed. 2002, 41, 1766; JACS 2004, 126, 6590; JACS 2005, 127, 3156; Acc. Chem. Res. 2005, 38, 449**). In a specific case, a reusable dip stick probe for the detection of Zn2+ under aqueous conditions has been designed (**JACS 2005, 127, 14962; Chem. Commun. 2008; patent application: PCT/IN08/00374 (Pub. No. WO/2009/084007**). The latest contribution is the design of a near infrared organic dye that can detect the total aminothiol content in human blood plasma (**Angew. Chem., Int. Ed. 2008, 47, 7883**), which is useful for the diagnosis of stress conditions in living systems.

The most recent finding is the use of a fluorescent gel for the attogram level detection of nitro aromatic explosives, particularly TNT (**JACS, 2012, 134, 4834**).

Currently, Dr. Ajayaghosh is exploring the possibility of using his materials as fluorescent security labels for currency and documents for which a patent has been filed (**0139NF2011**). A major breakthrough is the development of a reusable fluorescent paper on which self-erasable letters can be written using water as an ink (patent applied). In conclusion, Dr. Ajayaghosh has chosen a novel class of molecular systems, applied a rational approach to induce self-organization, and created exotic and functionally useful architectures of diverse size and shape with the idea of using them for practical applications, thus opening up a new field of research. His contributions have received wide attention of the scientific community and have been extensively cited. Several of his publications featured in the cover pages of journals and attracted mediate attention. His work has encouraged several young scientists in the field of chemistry in India to work in the area of organic functional materials based on molecular self-assemblies, gels and molecular probes.

Dr. Ajayaghosh has been invited as a plenary and keynote speaker to many national and international conferences, including the prestigious Aquitain Conference (2007) in France. He is a member of the International Advisory Board of Chemistry-An Asian Journal (Wiley) and served in the advisory board of ACS Applied Materials and Interface (ACS). His seminal contributions are recognized through several honors and awards. He is a recipient of the INSA Young scientist, Chemical Research Society of India and Material Research Society of India medals, Swarnajayanti research grant, Ramanna fellowship and DAE-SRC Outstanding Researcher Award. He received the Shanti Swarup Bhatnagar Prize in Chemical Sciences in the year 2007 and the Thomson Reuters India Science Front Award for the highest citation in the area of molecular self-assemblies. He is a Fellow of all the three Science Academies of India. Infosys prize for physical sciences 2012 is the latest recognition to Dr. Ajayaghosh.

(Dr.A Ajayaghosh is the CSIR-Outstanding Scientist, Chemical Sciences and Technology Division, National Institute for Interdisciplinary Science and Technology (NIIST), Trivandrum. He is the Vice President of SPSI, Thiruvananthapuram Chapter)

Carbon nanotube—a brief history

History of carbon nanotube provides some interesting information. It is surprising to note that carbon nanotube existed even in the 1950s. However, like many other nanomaterals, it was not known in that name at those times. It was Dr. Sumio Iijima , NEC Corporation, Japan, who identified the real potentials of this wonder material in 1991. Iijima should be given the due credit for popularizing carbon nanotube . The story of carbon nanotube is a perfect example of how journal publications are to be made. There should be a right combination of a high quality paper published in a high impact factor journal read by researchers in a wide spectrum of research areas, including those involved in basic research and fundamental physics coupled with the boost received from the article's relation to the earlier worldwide research hit (fullerenes, in this case), and a wave created by the entire concept ("nano"in this case), to get proper acknowledgment of your findings.

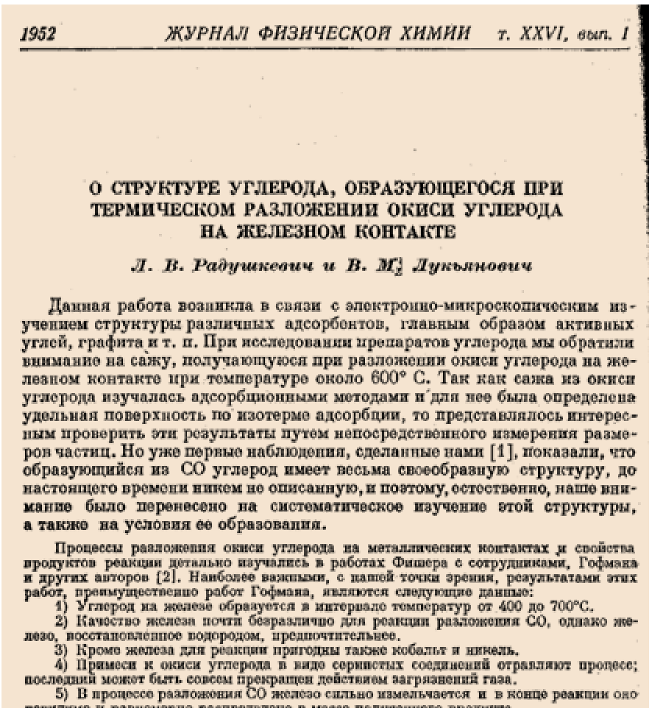
The timeline of carbon nanotube goes like this: In 1952, Russian scientists L. V. Radushkevich and V. M. Lukyanovich published clear images of 50 nanometer diameter tubes made of carbon in the Soviet Journal of Physical Chemistry. However, this discovery was largely unnoticed, as the article was published in the Russian language, and Western scientists' access to Soviet journals was limited at that time.

In fact, carbon nanotubes would have been produced even before this publication, but the invention of the transmission electron microscope (TEM) allowed direct visualization of these structures. Then comes Bollmann and Spreadborough, who published a paper in Nature in 1960 discussing the friction properties of carbon due to rolling sheets of graphene. In 1976, Oberlin, Endo, and Koyama published a paper in Journal of Crystal Growth titled "Filamentous growth of carbon through benzene decomposition", describing the Chemical Vapor Deposition (CVD) growth of nanometer-scale carbon fibers. They showed SEM and TEM images of a nanotubes consisting of a single wall of graphene. Later, Endo has referred to the TEM image as a single-walled nanotube.

Arthur C. Clarke was also instrumental in popularizing the application of carbon nanotube (after the buzz created by Ijima's paper). In his science fiction novel "The Fountains of Paradise" in 1979, he introduced the idea of a space elevator using "a continuous pseudo-one dimensional diamond crystal". Now the most promising material identified to make this concept a reality is carbon nanotube though nobody is clear how and when it would happen. In the meantime, John Abrahamson, in 1979, presented evidence of formation of carbon nanotubes on carbon anodes during arc discharge, at the 14th Biennial Conference of Carbon at Pennlsylvania State University. The conference paper described carbon nanotubes as carbon fibers. In 1981, a group of Soviet scientists published the synthesis and characterization of what they called "carbon multi-layer tubular crystals". They informed that these "crystals" were formed by rolling graphene layers into cylinders. They even suggested possibilities of different arrangements during the rolling of graphene-what we identified now as armchair and chiral nanotubes. Then, in 1985, fullerenes *were discovered which was the* turning point in carbon chemistry. In 1987, Howard G. Tennent of Hyperion Catalysis issued a U.S. patent for graphitic, hollow core "fibrils", which would have been called as carbon nanotube, had it been in the post Ijima "discovery" period.

There is no doubt that Ijima's discovery in 1991 helped to cre-

Contd. in page 4



1952 ЖУРНАЛ ФИЗИЧЕСКОЙ ХИМИИ т. XXVI, вып. 1

О СТРУКТУРЕ УГЛЕРОДА, ОБРАЗУЮЩЕГОСЯ ПРИ ТЕРМИЧЕСКОМ РАЗЛОЖЕНИИ ОКИСИ УГЛЕРОДА НА ЖЕЛЕЗНОМ КОНТАКТЕ

Л. В. Радушкевич и В. М. Лукьянович

Данная работа возникла в связи с электронно-микроскопическим изучением структуры различных адсорбентов, главным образом активных углей, графита и т. п. При исследовании препаратов углерода мы обратили внимание на сажу, получающуюся при разложении окиси углерода на железном контакте при температуре около 600° С. Так как сажа из окиси углерода изучалась адсорбционными методами и для нее была определена удельная поверхность по изотерме адсорбции, то представлялось интересным проверить эти результаты путем непосредственного измерения размеров частиц. Но уже первые наблюдения, сделанные нами [1], показали, что образующийся из CO углерод имеет весьма своеобразную структуру, до настоящего времени никем не описанную, и поэтому, естественно, наше внимание было перенесено на систематическое изучение этой структуры, а также на условия ее образования.

Процессы разложения окиси углерода на металлических контактах и свойства продуктов реакции детально изучались в работах Фишера с сотрудниками, Гофмана и других авторов [2]. Наиболее важными, с нашей точки зрения, результатами этих работ, преимущественно работ Гофмана, являются следующие данные:

1) Углерод на железе образуется в интервале температур от 400 до 700°С.

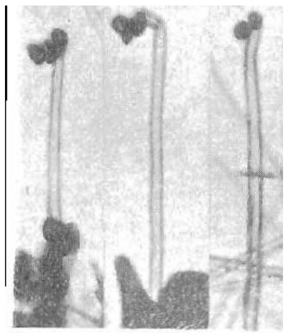
2) Качество железа почти безразлично для реакции разложения CO, однако железо, восстановленное водородом, предпочтительнее.

3) Кроме железа для реакции пригодны также кобальт и никель.

4) Примеси к окиси углерода в виде сернистых соединений отравляют процесс; последний может быть совсем прекращен действием загрязнений газа.

5) В процессе разложения CO железо сильно измельчается и в конце реакции оно

The first published report on carbon nanotubes by Russian scientists, V. Radushkevich and V. M. Lukyanovich in Soviet Journal of Physical Chemistry. Радушкевич, Л. В. (1952). "О Структуре Углерода, Образующегося При Термическом Разложении Окиси Углерода На Железном Контакте" Журнал Физической Химии 26: 88–95. Courtesy: http://carbon.phys.msu.ru/publications/1952-radushkevich-lukyanovich.pdf.



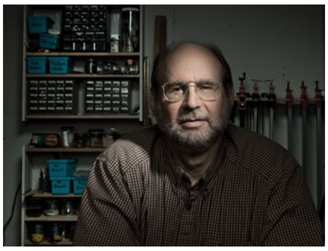
TEM images of what is now called carbon nanotubes, published by Radushkevich and Lukyanovich in Soviet Journal of Physical Chemistry. Радушкевич, Л. В. (1952). Figure clearly show carbon filaments exhibiting a continuous inner cavity, thereby forming tubes. The diameters of these tubes are in the range of 50 nm and are multi walled type.

"It is widely believed that Iijima's report in 1991 is of particular importance because it created awareness among the scientific community on the immense potentials of carbon nanotube"

Prasher is back to the research world!

All of us may be familiar with the names Osamu Shimomura, Martin Chalfie, and Roger Y. Tsien who jointly got the Nobel Prize in Chemistry for 2008 for the discovery and development of the green fluorescent protein, GFP. But many of us may not be knowing the name Douglas Prasher, who was until now a courtesy van driver in Huntsville, Alabama,USA, struggling to make a living with two children in college, payments of $750 for the family health insurance and... Douglas Prasher, who motivated the 2008 Nobel Prize Winners for their path breaking discovery, didn't get the prize because the Nobel Committee never picks more than three winners for any discovery!. And he lost his job too due to lack of funding! However, the Nobel Prize winners, Shimomura, Chalfie and Tsien rightfully remembered Prasher and invited him for the Nobel ceremonies in Stockholm, which he attended as the winners' guest. According to Chalfie, "Prasher's work was critical and essential for the work we did in our lab. They could've easily given the prize to Douglas and the other two and left me out.". Tsien also agreed that they couldn't have done it without Prasher. In 1988, Prasher received a two-year, $200,000 grant from the American Cancer Society for cloning the gene for green fluorescent protein (GFP), Prasher succeeded in this project, and later shared his findings with Chalfie and Tsien. In subsequent years,

Prasher provided the clone to hundreds of scientists. Unfortunately, his funding had ended by that time and he could not continue the studies what Chalfie and Tsien successfully carried out afterwards. Without getting a suitable scientific job, Prasher earned a living by working as a courtesy shuttle bus driver for $8.50 an hour (an early post-doc will get more than double of that amount!)

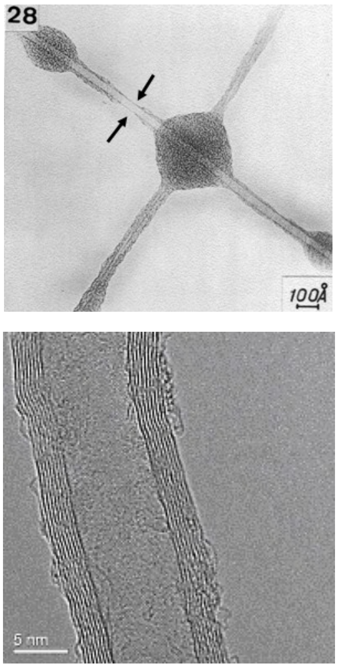


Douglas Prasher didn't get the Nobel Prize because "the Nobel Committee never picks more than three winners for any discovery"- a message to the "team players " in research filed! (photo courtesy: www.discovermagazine.com

The latest news is that Prasher is back to the research world as a Senior Scientist for a small contract research firm in Alabama.

Carbon nanotube... (contd. from page 3)

ate the initial buzz that is associated with carbon nanotube. Nanotube research propelled greatly following the independent discoveries by Donald S. Bethune at IBM and Iijima at NEC of single-walled carbon nanotubes (and methods to selectively produce them by adding transition-metal catalysts to the carbon in an arc discharge in fact, Mintmire, Dunlap, and White predicted in 1992 itself the remarkable conductivity that could be achieved by single walled carbon nanotubes) . It is widely believed that Iijima's report in 1991 is of particular importance because it created awareness among the scientific community on the immense potentials of this material.



TEM images of carbon nanotube in (top) 1970s and (bottom) 2010. (photo courtesy: Carbon 44 (2006) 1621 and www.polymathinterscience.com)

Rubber from sugar!

Two leading tire makers—Goodyear and Michelin—along with synthetic rubber manufacturer Lanxess are planning to make rubber from sugar! Using microbial fermentation three renewable rubber intermediates - isoprene, isobutene, and butadiene are expected to be produced, in order to meet the growing demands for isoprene, styrene butadiene and butyl rubbers and to help them in controlling the volatile raw material costs. David A. Benko, Director of materials research and development at Goodyear, says they are ready to use sugar-derived isoprene in its tires. To date, Goodyear has confirmed that biobased isoprene meets specifications for the catalysts it uses in rubber manufacturing. They have also made concept tires with it. Biobased butyl rubber made from isobutyl alcohol has passed the testing by the tire industry. Scientists have engineered a yeast strain to produce isobutyl alcohol from sugar by blocking competing pathways for ethanol and acetic acid. Researchers have also introduced a dehydration process to convert isobutyl alcohol to isobutene, which can then be polymerized to butyl rubber. Nonetheless, the promoters do not anticipate that microbes will be a reason for worry for the petrochemical industries or rubber tree farmers in the near future though commercialization of such concept is expected in the 2020s.

(Courtesy: Chemical and Engineering news– www. cen.acs.org)

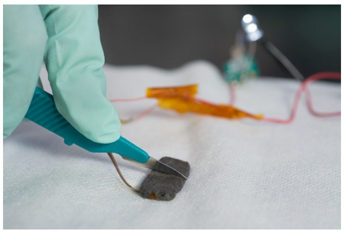
Polymer science and technology—major breakthroughs in 2012

Polymer skin that is self healing; sensitive too...

Human skin is not only sensitive, sending precise information to brain about temperature and pressure, but also self-healing against wounds and cuts. Combining these two properties in a single material is always a challenge to material scientists. However, a team of Stanford scientists, led by Prof. Zhenan Bao, has created the first synthetic material having both sensitivity and self-healing properties.

Though there is advancement in the development of synthetic skin, there are major drawbacks even for the most effective self-healing material. Some materials have to be exposed to high temperature making them impractical for daily use. Others heal at room temperature, but only once as the process changes and so does the chemical structure. The team in Stanford has achieved the milestone by combining the self-healing ability of a plastic with the conductivity of a metal. For this, they synthesized a polymer consisting of long chains of molecules joined by hydrogen bonding and added nickel nanoparticles to it. Hydrogen bonding makes the material self-heal. By tuning the electrical conductivity contributed by nickel nanoparticles, they made the material sensitive too. After cutting the material into two and then joining them by simple pressing for a few seconds, researchers found that the material gained back 75 percent of its original strength and electrical conductivity. The properties close to the original properties regained after 30 minutes, even faster than a human skin, which will take even one day to et completely healed.

(Courtesy: Stanford Report, November 11, 2012)



A small piece of the plastic material that is cut using a scalpel. It has the ability to heal itself within 30 minutes. (Courtesy: Stanford Report, November 11, 2012)

"After cutting the material into two and then joining them by simple pressing for few seconds, researchers found that the material gained back 75 percent of its original strength and electrical conductivity ."

Plastic solar cell with 10.7% efficiency

If we see the timeline of the development of organic photovoltaic (OPV), the efficiency increased from 3% in 2002 to 10.7% in 2012 when Heliatek GmbH, a German company, announced the prototype in Sept 2012. It all started when A. E. Becquerel observed photoelectrochemical process in 1839 . This was followed by the observation of photoconductivity in selenium by Willoughby Smith in 1873. The first solar cell was fabricated by Charles Fritts in 1883, which was based on selenium.

The first inorganic silicon based solar cell was developed by Bell Laboratories in 1954. The OPV device architecture was initiated in 1974 when P.H.Fang devises equation to convert between apparent efficiency and real efficiency. In 1977, R. D. Dupuis et al. created 12.8% efficiency in GaAlAs/GaAs cells grown through chemical vapor deposition.

In 1978, OPV broke the 1% efficiency barrier when Researchers from Exxon Mobil developed OPV device using semi-transparent aluminum electrodes. The first two layer OPV was developed in 1986 in which a single layer of organic material was sandwiched between two dissimilar electrodes having the efficiency of 0.95%. The first dye sensitized solar cell was reported in 1991 by O'Regan and Gratzel. In 1994, the first polymeric photovoltaic cell based on poly(2-methoxy-5-(2′-ethyl-hexyloxy)-1,4-phenylene vinylene) (MEH-PPV) and fullerenes was reported.

In 2002, the efficiency of polymer solar cell increased to 3% using fullerenes. G. Li et al. , in 2005, created 5% power conversion efficiency polymer photovoltaics using polymer blend of poly(3-hexylthiophene) and methanofullerene. In 2010, a power conversion efficiency of 7.4% was reported by Y. Liang et al. for OPV which was followed by 9.2% efficiency as reported by Mitsubishi Chemicals in 2011.

Let us hope that 2013 will bring improved efficiency for plastic solar cells with commercial viability to solve the energy crisis of the world.

(Courtesy: http://www.tiki-toki.com)

Graphene nanocomposites through click chemistry

A graphene sheet can be incorporated with poly(ε-carprolactone) (PCL) to enhance the mechanical and thermal properties of shape memory polyurethane (SMP) by properly dispersing graphene in the polymer through click chemistry. Click coupling is an emerging modification method for graphene's functionalization due to its high specificity, quantitative yield, compatibility with a variety of functional groups, and versatile applications under mild conditions. Click chemistry enables the synthesis of high performance of graphene-based polymer nanocomposites having high mechanical, electrical, and thermal properties. The use of the click coupling approach allows a high grafting ratio of PCL to a single graphene sheet, resulting in good solubility and processability. As a result of the successful grafting, the modified surface characteristics allow for a homogenous dispersion of functionalized graphene in the SMP matrix displaying a strong reinforcement effect. The study, carried out by Dr. Jae Whan Cho and his team, is published in Journal of Polymer Science: Polymer Physics .

(S. K Yadav, H. J Yoo,J. W. Cho, J Polym Sci Part B Polym Phys Volume 51, pages 39–47, 1 January 2013)

Story of four great polymers

We usually focus on the newest innovations in science and technology. But many past innovations in polymer science--the study of plastics and other similar materials--are still relevant and deserve recognition. They've saved lives, kept babies dry and made huge shark observation tanks possible. Some have tradenames that have gone on to represent an entire class of product, such as Kevlar. Others lurk in obscurity. Here are some of the most important materials and a glimpse into how scientists designed them to work their magic.

Polymethyl methacrylate (PMMA)

Applications: Lucite, dentures, aquarium windows
Developed in: 1877

PMMA is a very versatile polymer. If you ever see a clear plastic block, it's probably PMMA. It was first commercialized in the 1930s in Germany, and is now found anywhere one needs clear, strong material. This includes bulletproof "glass" at your favorite corner liquor store and the huge shark tanks at the Monterey Bay Aquarium. But my favorite use of PMMA is in so-called "frozen lightning" or Lichtenberg figure sculpture. Basically, put a chunk of PMMA into an electron accelerator, fire a bunch of electrons into the plastic until it's got about two million volts of charge, then touch the side of the plastic with a bit of wire and watch as bolts of lightning carve tracks inside the clear plastic.

Superabsorbers

Applications: Diapers
Developed in: 1960s

Back in the day, diapers were made from cloth. Frequently, those cloth diapers were filled with wads of natural absorbent fibers. Then polymer scientists discovered in the 1960s that they could make hydrogels like polyacrylic acid that absorb many times their own weight of water. It took about two decades, but polymer superabsorbers debuted in diapers in the mid-'80s. Superabsorbers are sometimes (but not always) polyelectrolytes, meaning that the side groups on the polymer chains are positively or negatively charged. That helps the chains associate with polar liquids like water.

Kevlar and Nomex

Applications: Bbulletproof vests and fireproof clothing, respectively
Developed in: early 1960s (Nomex); 1965 (Kevlar)

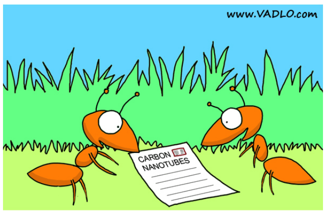
Kevlar and Nomex are two polymers that belong to a class of compounds called aramids--aromatic polyamides. Aramids have particularly strong chemical bonds, and materials scientist exploit that strength when creating impact and fire-resistant fibers from the polymers. For example, Kevlar fibers are especially strong because all of the polymer chains align, one right next to the other, during fiber spinning. Nomex has a slight kink in the polymer chain, which means that fibers made from it cannot line up perfectly, and thus will be slightly weaker. Both are relatively fire-resistant, but Kevlar's strength can stop bullets. In addition to bulletproof vests, Kevlar shows up in snare drum heads. Nomex is used in fire-fighters' protective gear.

Polystyrene

Application: Shrinky Dinks
Developed in: 1839

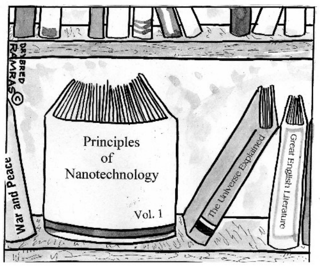
Shrinky Dinks are awesome. Color some strips of plastic, pop 'em in the oven and watch them fold up onto themselves. It turns out that these rainy day items are made from the same polymer as Styrofoam cups: polystyrene. Polystyrene, which was first commercialized in Germany in 1931 (styrofoam wasn't developed until 1954 in the United States), is a very versatile polymer and millions of tons of it are produced annually. A Shrinky Dink starts out as a sheet of polystyrene that has been pressed and flattened while close to the melting point. This forces the polymer chains to stretch out and line up. The sheet cools and the polymer chains are frozen into place (think of it as stretching out a Slinky and holding it). When you throw a Shrinky Dink in the oven, the polymer sheet warms up, and the polymer chains start to move around. When hot enough, all of the polymer chains coil back up, making the sheet of polymer shrink, just like a Slinky will pull itself together when you let go. Scientists at Northwestern University recently took advantage of that property to create nanopatterned surfaces. To get structures really, really close together, they used the stretched polystyrene and printed dots on the surface. Then they heated up the sheet, which shrunk, creating a very high-density array of dots.

On the lighter side...



"Finally, we can drink Coke with a straw."

(Courtesy: www.vadlo.com)



(Courtesy: ramrascartoons.blogspot.in)

"Oh, yeah! I've forgotten more about anionic polymerization in molecular adsorbents at interfaces through ion chromatography, thermal analysis and UV spectrophotometry for formulation of process development than you will every know"!

(Courtesy: www.cartoonstock.com)

Chapter News

Dr.S. Sivaram releases the Souvenir of the National Seminar by handing over a copy to , Prof. (Dr.) A. Jayakrishnan,(left) Vice Chancellor, University of Kerala. Dr. C. P. Reghunadhan Nair,,President SPSI Thiruvananthapuram Chapter is seen on right.

A view of the poster session of the seminar

One day seminar conducted

SPSI Thiruvananthapuram chapter , in association with Department of Chemistry, Mar Ivanios College, organized one day National Seminar on "Recent Advances in Polymer Science and Technology" on 23rd June 2012. The seminar was a great success with participation of more than 120 researchers and students both within and outside Kerala. The Seminar focused on introducing latest advancements in the field of polymer science and technology to postgraduate students and research scholars by eminent scientists and researchers in this field. Student researchers were also encouraged to present their work in the form of poster presentations.

The Seminar was inaugurated by Dr. S. Sivaram, CSIR Bhatnagar Fellow, NCL, Pune and he delivered a very informative lecture on "The Science of Polymers: Past, Present and Future". He motivated the students and young researchers giving examples of great polymer chemists/ technologists and their achievements. Following the inaugural session, there were three plenary lectures given by Dr. Vijayamohanan K Pillai, Director, Central Electrochemical Research Institute (CECRI), Karaikkudi , Prof.R. Dhamodaran, IIT, Madras and Prof.Bhuvanesh Gupta, IIT, Delhi.

In the afternoon session, there were about 35 poster presentations by student researchers. From these, the review committee selected best three posters and the awards were presented during the concluding Session.(1) Kum. Deepalekshmi P, School of Chemical Sciences, MG University, Kottayam, Kum. S. R. Rejeena, Department of Chemistry, University of Kerala, Kariavattom Campus and Smt. Smitha C Sukumaran, Polymers and Special Chemicals Division, VSSC, Trivandrum have received the awards.

The concluding session was conducted as an interactive, panel discussion session between the invited speakers and participants.. This National Seminar turned out to be a great success with participation of more than 130 college students and researchers across Kerala.

Awards and Honors

- Dr. A. Ajayaghosh, CSIR-Outstanding Scientist, Chemical Sciences and Technology Division, NIIST, Thiruvananthapuram has been awarded the Infosys Prize for Physical Sciences –2012.
- Dr. A. Ajayaghosh has been recognised by the Wiley-VCH publications for having contributed 15 articles to the journal Angewandte Chemie over the past 10 years. A one-page write-up on Dr. Ajayaghosh has been published in the international edition of the high-impact journal.
- Dr. S. Mahesh, Department of Chemistry, IIST, Thiruvananthapuram and Dr. Bindu P Nair, SCTIMST, Thiruvananthapuram have been awarded Kerala State Young Scientist Award, instituted by Kerala State Council for Science, Technology & Environment for their contributions in the fields of chemical science and materials science respectively.
- Shri R. Biju, Research Student, PSCG, VSSC has received ISAMPE -2012 student category award for Smart Materials and Systems Technology Development for the paper on "Investigations on Shape Memory polymers for Space Applications"
- Smt. Bismi Basheer, VSSC, has won second prize in the category of Best Oral Presentation in the Second International Conference on Optoelectronic Materials and Thin films for Advanced Technology (OMTAT 2013) held in Cochin. The paper was co-authored by Temina Mary Robert, Vijayalakshmi. K.P, Dona Mathew (all VSSC) and Honey John (IIST)
- Smt. Smitha C. Sukumaran, Polymers and Special Chemicals Division, VSSC, has won the Best Paper Award in the National Seminar on Recent Advances in Polymer Science and Technology, held in Thiruvananthapuram.
- Dr. V.L. Reena has won the gold medal for the Best Ph.D Paper, during the Annual General Body Meeting of SPSI in January 2012. She did the Ph.D under the supervision of Dr. J.D. Sudha and Dr. Dr.C.Pavithran, NIIST, Thiruvananthapuram.
- The paper authored by Deepa Devapal, T. V. Sebastain, P. V. Prabhakaran and S. Packirisamy (all VSSC) has received Second Prize in the International Conference on Advances in Metallic Materials and Manufacturing Processes for Strategic Sectors (ICAMPS), held during January 19-21, 2012.
- N. Supriya and R. Rajeev (VSSC) have received Best Poster Award (Second Prize) in the DAE-BRNS International Symposium on Thermal Analysis (THERMANS – 2012), Jan31-Feb02, 2012 at BARC.
- The paper authored by M. P. Gopakumar, Deepa Devapal, P. V. Prabhakaran and S. Packirisamy won the Best Poster Award in National Conference on Carbon Materials-2012, Nov.1-3, 2012, Mumbai.

Congratulations!

Dr. A. Ajayaghosh

Dr. S.Mahesh

Bismi Basheer

Dr. V.L. Reena

Smitha C Sukumaran

R. Biju

Deepa Devapal

N. Supriya

A newsletter of the Society of Polymer Science, India, Thiruvananthapuram Chapter

Please contact:
Dr. Gouri C
Head, Lithium-ion Electrodes Section
LFCD, Energy Systems Group
Vikram Sarabhai Space Centre, Thiruvananthapuram -695 022, Kerala, India.
Phone: 0471 2562584; Fax: 0471 2562115
Email: gouri_cheruvally@vssc.gov.in; gouri_c@yahoo.com

Please visit our website at www.spsitvm.org for updated information on Chapter activities, latest research findings on polymers etc.

follow us on twitter

Find us on facebook

Seminars/talks organized during 2012

- "Nitrate Ester- Polyester (NEPE) Propellants", by Dr. Manoj Gupta, Associate Director, HEMRL, Pune on 27th March 2012 - jointly organized by SPSI with HEMSI, Thiruvananthapuram Chapter
- "An Introduction to Thermal Activity Monitor (TAM) and applications to Materials Science", by Dr. Peter Vikegard, TA Instruments, Sweden on 07th September 2012 .
- "Ferrite-Polybenzoxazine Nanocomposites: Synthesis Challenges, Magnetic and Mechanical Properties", by Dr. Narendranath Ghosh, Birla Institute of Technology and Science, Goa on 19th December 2012
- "Functional Polymers using controlled radical polymerization and click reaction", by Dr. Nikhil K Singha, IIT, Kharagpur on 19th December 2012.
- A Special Interactive Meeting of SPSI members with Prof. (Dr.) A. Jayakrishnan was held on 25th November 2012 at to felicitate him on the occasion of his completing tenure as Vice Chancellor, University of Kerala on 14th December 2012.

Send your feedback to spsitvm@gmail.com

Following SPSI members superannuated from their respective organizations in 2012

Smt. J. Geetha, VSSC

Shri A. K. Bhaskaran, VSSC

SPSI wishes the members a happy, prosperous and purposeful retired life.

SPSI Thiruvananthapuram Chapter
Officer bearers—2012-'14

President	:	Dr. C.P. Reghunadhan Nair (Group Director, PSCG, VSSC)
Vice President	:	Dr. A. Ajayaghosh (Director-grade Scientist, NIIST)
Secretary	:	Dr. C. Gouri (VSSC),
Treasurer	:	Dr. R.S. Rajeev (VSSC),
Joint Secretaries	:	Sri. N.S. Mussath (VSSC) and Dr. Roy Joseph (SCTIMST)
Executive Committee	:	Prof. (Dr.) A. Jayakrishnan (IIT, Chennai), Dr. J.D. Sudha (NIIST), Prof. (Dr.) Joseph Francis (formerly CUSAT), Sri. V.P. Balagangadharan (VSSC), Dr. Benny K George (VSSC), Dr. Renjith Devasia (VSSC), Dr.. M. Nallaperumal (VSSC), Prof. (Dr.) T.S. Anirudhan (University of Kerala), Prof. (Dr.) Kuruvilla Joseph (IIST), Dr. C. Radhakumari (SCTIMST).

Published by SPSI Thiruvananthapuram Chapter.