Polymer Students Association
MIT,Pune

POLYMER TIMES

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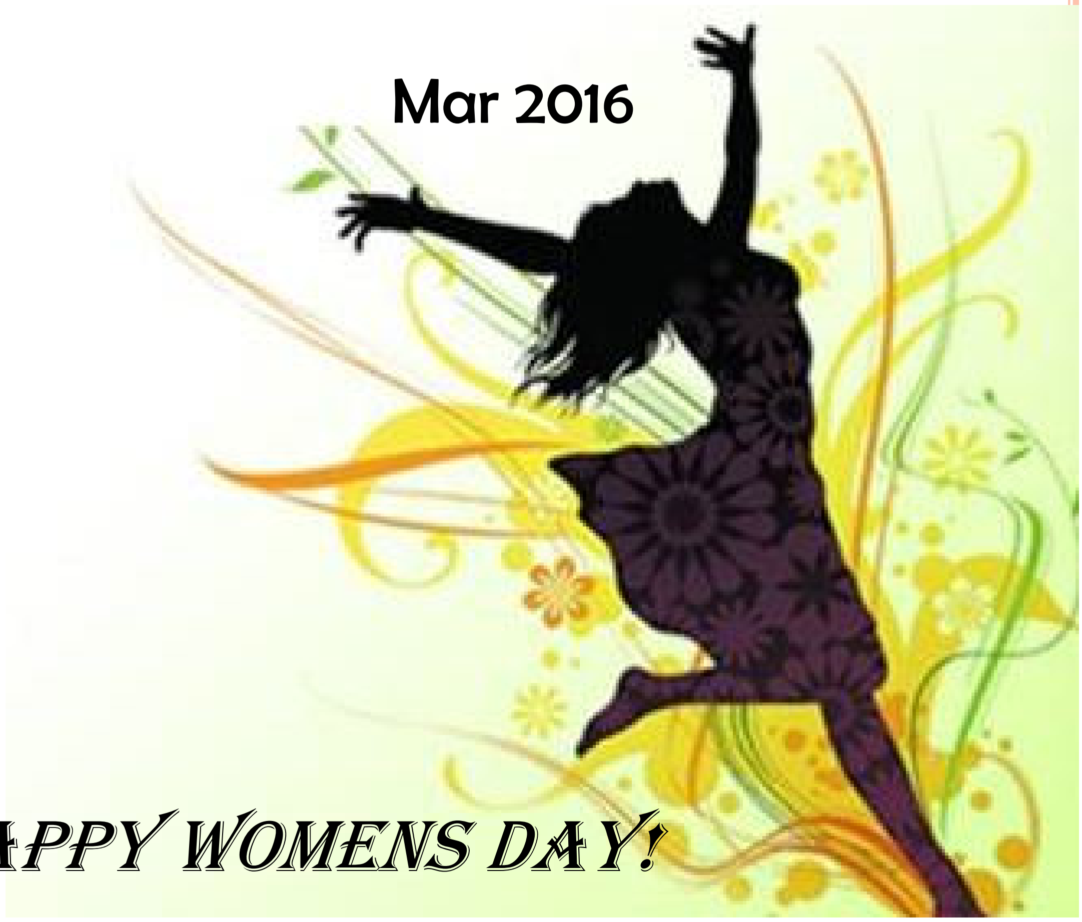


HAPPY WOMENS DAY!

From HOD's Desk

This edition features about different conferences going to be held across various institutes in Pune and along with the various recent developments in the field of Polymer Science and Technology.

This month's issue also features an interview with Dr. Bellare and highlights of the same along with the glimpses of annual department event Affinity & Confluence'16 are present.

We wait for your feedback & participation in crossword.

Dr. K. D. Patil
Head of Department
Polymer Engineering, MIT

Happy Reading ☺

Women in Science

These are a few personalities who have brought great pride to the scientific community. The women mentioned above are not as well-known as they ought to be, but by the end of the article we endeavor to enlighten the readers about the momentous changes the above personalities and the like have made in the world of science.

This month’s issue is glad to celebrate women’s day, contrary to the notion that the scientific field is male dominated, people are just not fully aware of competent woman in this world of science.

I would like to begin with **Marie Curie**. She was a physicist and chemist who conducted pioneering research on radioactivity. She was the first woman to win a Nobel Prize, the first person and only woman to win twice. Her achievements included the development of the theory of radioactivity (a term that she coined), techniques for isolating radioactive isotopes, and the discovery of two elements, polonium and radium. Under her direction, the world's first studies were conducted into the treatment of neoplasms, using radioactive isotopes.

Julia Higgins Professor of polymer science, Imperial College London. After obtaining a first degree in Physics she undertook research in the field of Physical Chemistry. She started using neutron scattering as a tool for investigating molecular structure and dynamics, first applying the techniques to the study of polymers while a post-doctoral research assistant in the Chemistry Department at Manchester. She is well-known for her studies of the dynamics of polymer molecules, especially in the bulk state and, more recently the thermodynamics and demixing processes in polymer blends.

Kathleen Lonsdale, A pioneer of X-ray crystallography – the study of molecule shapes – in 1945 she and Marjory Stephenson were the first women to be admitted as fellows to the Royal Society. She was the first female professor at University College London, and the first woman to be president of the British Association for the Advancement of Science.

Apart from field of physics or chemistry, **Prabha R. Chatterji** is an Indian scientist at John F. Welch Technology Centre (formerly General Electric Global Research and Technology Development center), Bangalore, India. She has been formerly a senior scientist at Indian Institute of Chemical Technology, Hyderabad and a past member of the Executive Committee of the Society for Biomaterials and Artificial Organs, India.

Even at this age and era we live in a society where in shockingly, we have very little awareness when it comes to impact made by such women.

We wish to take pride in celebrating these women and their contributions and inspire budding young women to pursue their dreams of a career in science, research and technology.

A very inspiring feat by Professor Anna Balazs is described in the next section.

Pitt professor first woman to win Polymer Prize

Anna Balazs, a petroleum and chemical engineering professor at Pitt, will become the first woman to receive the Polymer Physics Prize, an honor the American Physical Society awards annually to any physicist worldwide for excellence of contributions to polymer physics. She will receive the prize in March of next year.

The prize comes with a check of $10,000, with many distinguished leaders in the field including Pierre-Gilles de Gennes, Sir Samuel Edwards and Glenn Fredrickson as its recipients.

The prize recognizes her work with theoretical modeling of polymers — or clusters of repeating molecules — and their relevance to experiments, allowing her and other researchers to better understand polymers' behavior and create more accurate physical experiment

Uber for polymers-creating polymers that repair themselves and polymers that pick up molecular objects and move them to different locations in a tissue or cell. Balazs and Todd Emrick, the director of the National Science Foundation's Materials Research Science and Engineering Centre, are working together on this research. Balazs and Emrick think other researchers could use their "Uber" to transport cells and enable them to deliver minerals to or demineralize a certain area of the body.

Her colleagues agree that her ability to use theories and experiments in tandem to solve problems distinguishes her as a leader.

Glimpses of the Event

Upcoming events

NCBKVAP-2016

NATIONAL CONFERENCE ON

"BIORESOURCES AS A KEY TO VALUE ADDED PRODUCTS"

(April 29th & 30th, 2016)

Conference Schedule for 9th April, 2016 has been postponed to 30th April, 2016

INTERNATIONAL CONFERENCE

On

"Recent Trends in Mechanical, Material Science, Manufacturing,
Automobile, Aerospace Engineering and Applied Physics"
(AMAEAP-2016)

Organized by

"Krishi Sanskriti"

On

~~**9th April, 2016**~~

30th April, 2016

Venue:

Jawaharlal Nehru University,
New Delhi-110067

Recent Developments

Mirror, Mirror: Polarimetry Testing & Optical Rotation

Only about 1 percent of people are truly ambidextrous — able to use both hands with equal dexterity to perform a variety of tasks, like writing. For the rest of us, our hands may be mirror images of each other but they don't function in completely the same way. The same is true of molecules. Two molecules may be identical in terms of chemical composition, but if they are mirror images of each other they won't function in exactly the same way. The concept of chirality addresses the orientation of molecules — whether they're "left-handed" or "right-handed." We test the orientation of molecules with a polarimeter, which measures the optical rotation caused when we pass light through a given material. How the light rotates tells us the orientation of a molecule. Alice could have made great use of the device when she found herself stuck in Wonderland, frustrated that she couldn't explain herself because she wasn't herself. Polarimetry would have helped her determine if she was the "real" Alice or the looking-glass version! To help you visualize chirality, hold your hands in front of you palm up, side by side. Now turn your hands to bring your palms together. The position of your fingers matches up perfectly, thumb to thumb and pinky to pinky, as if you were holding one hand up to a mirror. Next, with your hands side by side, move the left hand over your right. They don't line up – the pinky of your left hand is above the thumb of your right hand. That distinction is critical in the world of polymer testing.

Here's another way to understand chirality. If you were to analyze pure sucrose, which has a known polarimetry, your expected value would be +66.37. However, if someone switched your sample, replacing it with "looking-glass" sucrose, you would discover a value of -66.37, indicating the molecules are oriented in a mirror image. Would it taste as sweet as "real" sucrose? Alice didn't seem to think so.

Alice's dilemma was the stuff of children's entertainment, hardly life and death. But in polymer science chirality can affect how a substance behaves during the manufacturing process and in use. For example, Poly(lactic acid) (PLA) is a type of biodegradable polymer that's used extensively in medical applications. Lactide, the key component of PLA, is an enantiomer — a molecule that has a mirror-image counterpart. Chemically, L-lactide and D-lactide are the same, but the molecular elements that comprise them are mirror images, reversed along one axis. Polarimetric testing can help us identify different types of PLA and determine whether the resin has been enantiomerically enriched or not, because while they are both PLA, they have vastly different properties and behave in very different ways depending on the degree of enantiomeric enrichment.

Polarimetry testing can help us identify a molecule and predict how it will behave based on its orientation. It can also aid us in discovering if a client has accidentally caused racemization to occur in a sample. Additionally, the test can help companies ensure their materials are conforming to specifications.

Poor Alice only had the Mad Hatter and a handful of bizarre characters to try to make sense of the looking-glass world. Fortunately, a polarimeter ensures we can do much better in the world of polymer science!

We do the hard stuff: HPLC Analysis

We'll never argue that science is simple. In fact, parts of it are so complex that even the experts can find themselves at a loss as to how to use tried-and-true scientific measures to answer a burning question. That's often the case with HPLC (high-performance liquid chromatography) of polymers.

HPLC is an immensely helpful type of chemical testing that scientists often use to separate components in a mixture, identify what they are, and determine how much of each is present in a solution. The testing involves pumping a pressurized liquid solvent that contains the sample liquid through a column filled with a solid, adsorbent material. The atoms, ions or molecules of each component in the sample solution will interact differently with the adsorbent, ultimately causing the components to separate as they flow out of the column. Once separated, we can identify and measure the components.

Pretty nifty, eh? Except HPLC works best with small molecules, and as we know, your typical polymer molecule is anything but small.

HPLC anaylsis of polymers (other than proteins) is rare and very challenging," says Jason Todd, our chromatography lab manager and expert. "The choice of solvents that can dissolve a polymer is typically very limited, compared to small molecules, and limits the type of HPLC method you can use. Also, polymers contain a distribution of chain lengths, which often will result in multiple peaks or a very broad peak during the HPLC separation. We need a single, fairly narrow peak to quantify the amount of each polymer that is present. Achieving a single, narrow peak for each polymer requires a lot of method development in terms of finding the right HPLC column and mobile phase solvents."

Recently, Polymer Solutions took on a job that had stymied two other labs. The client asked PSI to quantify preservative compounds (parabens) present in a water-based cleanser that contained a polymer. In initial tests, the polymer didn't behave as anticipated and some of the preservative compounds weren't very water-soluble, so they didn't respond well in HPLC testing.

After discussing with the client performance requirements and what previous testing other labs had tried, PSI's team gathered information on the composition of the test sample and the properties of the polymers, including molecular weight, chemical composition and solubility. A literature review turned up useful testing information for one of the polymers, but nothing on the other.

"At the time we were beginning the method development, I was fortunate enough to be attending a technical conference dealing with polymer analysis, and I was able to gain valuable insight by attending presentations and talking with leading experts in the field of polymer HPLC separations," Jason says.

Our team used orthogonal HPLC methods to perform initial screening experiments. We chose one HPLC method for further development, based on its initial performance in separating the target polymers. We refined the method parameters until we could achieve optimal results from the testing. We also developed a method for sample and standard preparation, and did accuracy and precision studies to verify the method we'd developed would be suitable for its intended use.

"This example is typical of our process for method development," Jason says. "We start by identifying the client's objective (quantify preservative compounds present in an aqueous cleanser formulation) and any known constraints (such as available sample amount) and potential issues (a polymer is present, which could interfere with the analysis). We then choose an appropriate analytical method (HPLC, GC, etc.) based on the physical properties (volatility, UV absorbance) and expected concentration range of the targeted analytes. We use our knowledge of polymer solubility to identify appropriate solvents and extraction techniques. We then proceed with the method development, using our knowledge and experience to deal with any issues that are encountered along the way.

"Our goal is to end up with a method that is suitable for its intended use, in terms of being able to measure the concentrations of the target compounds with acceptable accuracy and precision."

Solid Phase Micro-extraction: So Sensitive!

Many analytical methods used in polymer testing involve turning a solid sample into a liquid or gasprior to analysis. This allows scientists to better analyze the molecules that make up the polymer. Sometimes, however, those methods can be too time-consuming, difficult to accomplish without complications or contamination, or unable to detect the level of detail you need. Solid phase micro-extraction (SPME) is one solution to those challenges.

SPME is a sampling technique that uses a fiber coated with an extracting phase (usually a polymer, sometimes a solid sorbent) that extracts different kinds of analytes from various materials. SPME is a powerful analytical tool that reduces the number of steps involved in testing (and thereby the risk of error) while eliminating the need for a solvent to turn a sample into a liquid or gas. It can be used for liquid or volatiles sampling, but we usually use it for volatiles testing. It's fast, it doesn't usually use solvents, and you can get down to ppt levels for some compounds. It's particularly helpful anywhere you need to achieve highly sensitive analysis of materials, such as in packaging.

An Inspiration

Dr. Jayesh R. Bellare is Institute Chair Professor at the Department of Chemical Engineering, I.I.T. Bombay, Mumbai. He has been at IITB since July 1990, and along the way he has also been visiting Professor at ICT (formerly U.D.C.T., Bombay University) and the University of Minnesota, USA. He is an elected fellow of the National Academy of Sciences, India, the Indian National Academy of Enginering, the Maharashtra Academy of Sciences, and the Electron Microscope Society of India.

He was born and bred in Mumbai, where he did his schooling at the Bombay Scottish School and his B.Tech. in chemical engineering from I.I.T. Bombay (where he stood first with Silver Medal in 1982). He earned his Ph.D. (in 1988) in Chemical Engineering and Materials Science from the University of Minnesota, Minneapolis, U.S.A. for his work on cryoelectron microscopy and polarized optical microscopy of colloidal surfactant systems (with Professors H. Ted Davis and L. E. Scriven). He was visiting researcher at the Department of Chemical Engineering, Technion Israel Institute of Technology, Haifa, Israel (1984, with Professor Y. Talmon). He was post-doctoral fellow in Mathematics and in Polymer Science and Engineering at the University of Massachusetts, Amherst, U.S.A. (1989) and in Materials Science and Engineering at M.I.T., Cambridge, U.S.A. (1990) on microphase separated copolymers, electron microscopy of their morphology, and simulation of their interfaces (with Professors David Hoffman and E. L. Thomas).

He has several international publications, conference presentations, and patents. He has lectured at several research centers, including Caltech, IBM Almaden, and Sohio. He is the inventor on nine patents, two of which are being commercially used internationally. His awards include the I.C.I.-IIChE Excellence in Process/Product Development Award (1996), the N.R.D.C. Invention Award (with Prof. A. P. Kudchadker); the Presidential Award of the Electron Microscopy Society of America; the Kazato Award, Kyoto, Japan, the Best microscopist from Developing Countries Award of the Microscopy Society of America, and the Piercy Distinguished Visiting Professorship. University of Minnesota, USA. Dr. Bellare joined I.I.T. after spending eight years in the U.S.A.

Dr. Bellare's research interests are wide; they include: nanomedicines across different systems medicine, drug formulations, drug delivery systems, microstructure engineering; ultramicroscopy; nanomaterials; liposomes; specialty glasses; siilcates; membranes; biomedical devices; sensors; membranes; surface modification of polymers; and instrument prototyping. Dr. Bellare strongly believes in close interaction between academia and industry. He is a very astute technology evaluator. He is very active as a consultant for industry and on many government panels.

Excerpts from conversation

Q. What inspired you to choose this field as career?

I think I had many things in my life which inspired me, it was not an active choice. I had a hobby of photography, so photography led to microscopes and then it led to microphotography and it was the understanding of images that got me into structure of materials and eventually into nanomaterials and polymer materials. So technically, a technical hobby that grew into professional interest is how I made this field as a choice.

Q. You have visited many colleges & universities and also gone through the syllabus of various courses. Where do you think India lags behind in terms of quality education? What changes do you suggest for the same?

The problem with Indian education is not at the higher level, I think it is at home and at primary school and I blame home as not many parents encourage curiosity. I often see kids asking their parents or teachers like, "what is it?" or "how is it so?", and they don't get good answers and their curiosity is suppressed. So these are issues that unfortunately prevent us from being curious. Often time we are embarrassed to say that I don't know. I think there is a bigger sense of openness and discovery at school level in institutions abroad.

Q. We live in such a society where most parents ask their ward to complete graduation, post graduation and find a safe & secure job but no one encourages doing a start-up or becoming a full time entrepreneur. What are your views on this?

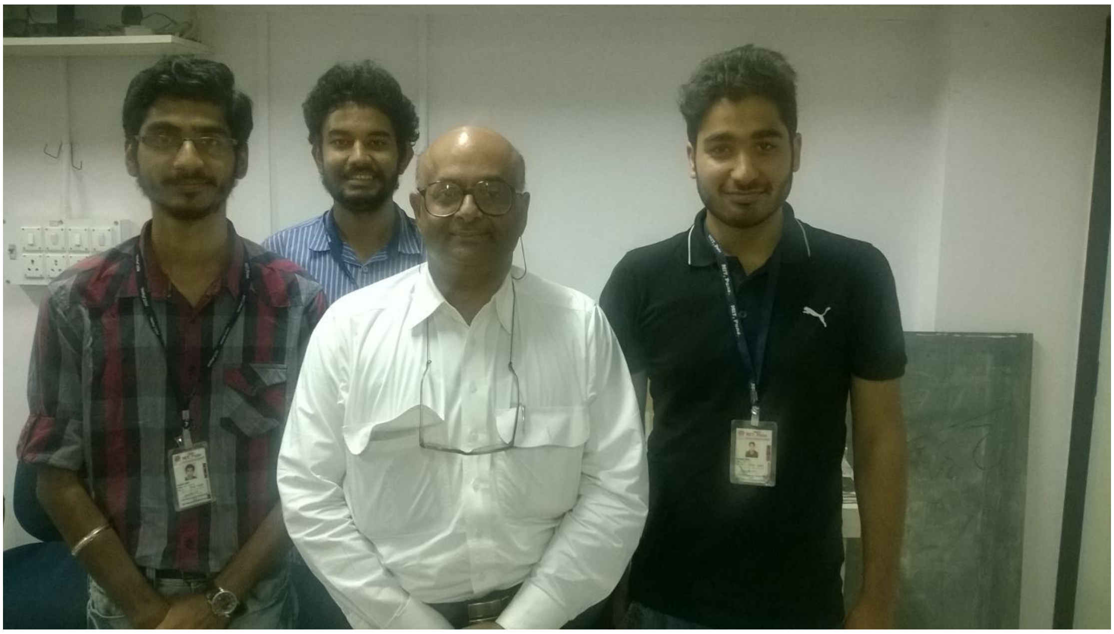
Times are changing, I don't think today young parents will stop a child experimenting and thinking about a startup. That is because today a startup culture is an acceptable way of beginning ones career, so startup culture is good and there are few of my students thinking like so, there are problems due to lack of job security but these problems are in most sectors today and even traditional safe govt. jobs are no longer secure. For example government pension is gone today. So I think startup as a job choice is far more acceptable

Q. Research in nanotechnology begins at lab bench, often without much thought given to future commercialization. Scaling up processes for production is the biggest challenge of this field. What are your views on this scenario?

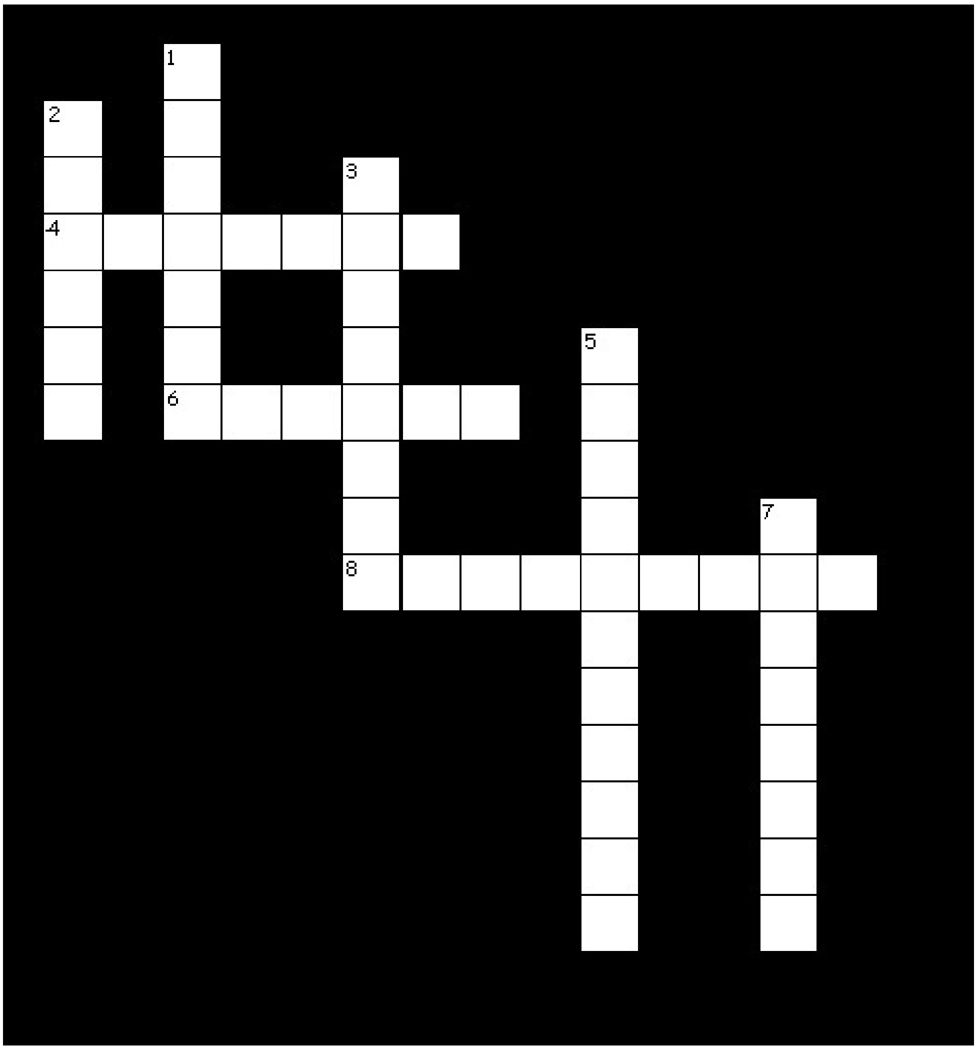
I was a part of some early startups in nanotechnology, there are few who managed to survive, and it is not something that has a ready market. One has to be very careful, if the value proposition is correct or not. Just because a nanomaterial has advantages you cannot assume it will find a market; it is very difficult. So you should see how can you satisfy market needs. Or if you are so resourceful to generate a market need! This is what matters.

Q. Considering the application of polymer technology in India we have observed that older technologies are still in use which may not meet the international standards. According to you what may be the alternative?

The alternative for this is to skip generations, like has been done for car engines; we are going straight from BS4 to 6 skipping stage 5. We are skipping setting up landlines in rural areas and straight going to cellphones. We need to skip generations of technology and that's what we have been doing in other fields as well e.g. in case of health care. We need simply to bring health care homes because there are not so many possibilities of special hospitals for some of the simpler diseases that can be treated at home. This needs to be done across disciplines, including polymer technology.



Crossword



Down
1. Natural polymer that can be used as a high-gloss varnish or a glazed pill coating.
2. innovation house for most of the polymers
3. weather resistant polymer
5. Long form of P in IPN
7. first company to start polyester in India

Across
4. Macromolecule
6. Impact test method
8. Polymer with high degree of elasticity.

HOPE YOU ENJOYED THE FOURTH ISSUE OF "POLYMER TIMES"

PLEASE SHARE YOUR FEEDBACK OR SUGGESTIONS

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