HIPF has organized the seventh technical fair for the inter group participation like Injection Molding - Group O1 and O2, Blown Film - Group N1, Blow Molding - Group O3 and O4 and Pipe Extrusion – Group N2. The main objective of this event is to promote learning for understanding among the trainees and also it gives them an opportunity to demonstrate their skills and knowledge in plastics technology. All the trainees participated actively in technical fair and made it a grand success.

PEF - a material that has potential to replace PET

Polyethylenefuranate(PEF) is 100% bio-based and recyclable polymer derived from plants having the potential to replace PET. The functional quality of PEF material, barrier properties and thermal behavior makes it, an alternative for PET. PEF is manufactured from bio based mono ethylene glycol (MEG) and Furonidcarboxylic acid (FDCA). This material was developed by Avantium using YXY technology in collaboration with coca-cola company.

The advantage of PEF over PET is:

- Oxygen barrier properties 6 times greater than of PET
- Carbon-di-oxide barrier properties 3 times better than PET.
- Water barrier properties- 2 times better than PET.

PEF is more promising than PET because of its superior heat resistance. The Tg value of PEF is 86°C compared to 74°C for PET. Which is useful for any products to fill up to the temperature of 86°C.

The melting point of PEF is 235°C compare to PET’s 265°C, so less heat energy involve in the process, and there is no chances of AA gas evolution as in PET. It also has other benefits like good mechanical properties and recyclable capacity.

PEF has been demonstrated to be a promising material for manufacturing of fibers to make 100% bio-based T-shirts for textile manufacturers.

SPECIAL POINTS OF INTEREST:
- Recent Path Breaking Innovations in the field of Plastics.
- Selected International Plastics centered events and exhibitions.
- 7th HIPF’s Technical Fair for N and O group trainees.

IN THIS ISSUE:
- PEF – a material that has potential to replace PET.
- Functionalized carbon Nanotubes(CNT) to achieve better mechanical and electrical properties.
- Back to basic – a key to success in managing business operation
- Role of plastics membrane in sea water purification.
- Polymers in hologram recording – a new method of expression.
- International Plastics Events.
Functionalized Carbon Nanotubes (CNT) to achieve better mechanical and electrical properties

CNT is used as micro filler in polymer matrix to enhance mechanical properties but it is experienced that the untreated CNT does not give any gain in strength. When the surface of the CNT is modified it is called functionalized CNT. This form of CNT contributes a tremendous gain in mechanical property which is directly related to the dispersion of CNT in polymer matrix. The functional CNT creates better adhesion between CNT and polymer. The surface of CNT is modified by plasma treatment. The plasma parameter of power and time is adjusted to get the desired chemical function. By this method we can tailor the surface of the CNT for specific plastics. Also too much plasma power is not to be used to avoid degradation of CNT. For example the Nylon 6 has carbonyl group so we do the ammonia plasma treatment of CNT to incorporate ammonia group on CNT surface which further interacts with carbonyl group and achieve better dispersion. The plasma treatment is done at 13.56 MHz, up to 100 watt power and at 300°C. There is an interesting gain in mechanical property as shown.

<table>
<thead>
<tr>
<th>Property</th>
<th>Nylon 6</th>
<th>Nylon 6 1% functionalized CNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile modulus (MPa)</td>
<td>396</td>
<td>852</td>
</tr>
<tr>
<td>Tensile modulus (MPa) Strength(MPa)</td>
<td>18</td>
<td>40.3</td>
</tr>
</tbody>
</table>

The material is flexible and can be easily manufactured by mixing polymeric material with 9-10% boron-nitride nanosheets. This combination makes the material unique in its heat resistance, high di-electric and bendability.

Back to basic - a key to success in managing business operation

The BACK to BASICS strategies in managing costs should contain operational KPI’s (Key Performance Indicators) that is focused on: COST, QUALITY and DELIVERY strategies.

1. COST: Operational cost should be managed accordingly to increase companies’ profitability.
   1.1. This strategy is not only focused on continuously developing and improving the existing product lines in order to achieve sales targets but rather how to control operational costs. Therefore, preparation of an operational plan/strategy in managing cost is a must.
   1.2 The operational strategy normally being set in terms of percentage is: Gross profit = Sales – [Cost of Goods Sold (COGS) = Material cost + Labor cost + Overhead cost].

   where:
   - Material Cost = 50% (yield of main materials including packaging cost)
   - Labor cost = 15% (salaries and wages of workers)
   - Overhead cost = 25% [administrative (direct & indirect) and all other cost]
   - Expected gross profit margin = 10%

   Therefore, reduction in any of COGS increases company’s profit.

2. QUALITY: ADHERENCE to CUSTOMER’S QUALITY REQUIREMENTS – to meet Product Quality set or expected by customers. It is also advisable to include:
   2.1 Acceptance Quality Level (AQL) – normally set below 0.3% base on Quality (YTD) Inspection Report.
   2.2 Scrap Rate Reduction – normally set below 0.3% base on Quality (YTD) Inspection Report.

3. DELIVERY: MAINTAIN MACHINE OPERATING TIME OF 85% AND ACHIEVE 90-100% WORKING EFFICIENCY – Comprehensive Preventive Maintenance Program and Standard Operating Procedures (SOP) should be in place.
   3.1. Minimize downtime during stabilization time, shift change over, mold changes, process troubleshooting, materials & colors changes and all other activities that may results to downtimes.
   3.2 Meet Production targets – in order to meet delivery schedules all the time, employees must have proficient technical skills and excellent work ethics. Therefore, companies must continuously provide technical and soft skills training to their employees.

The BACK to BASICS strategies in managing business operations: COST, QUALITY and DELIVERY are the highly recommended not only to new or start-up companies but also to existing companies to ensure success all the time.
Water is very important for sustaining life on earth. But in many regions, especially in Gulf countries, the availability of fresh drinking water from natural spring and underground is very less. Therefore the sea water has to be purified. Many methods are employed to remove the salt content present in sea water.

Membrane distillation method (MD) is one of the emerging, cost effective, attractive and alternative desalination technologies employed for desalination/purification of seawater or waste water (domestic, municipal or industrial). Hydrophobic microporous membranes fabricated from inexpensive polymers such as polytetrafluoroethylene (PTFE), polyvinylidene fluoride (PVDF), polypropylene (PP), polyethylene (PE) etc.

A noteworthy feature of membrane distillation method is that the potential driving force for the distillation process is difference in vapor pressure created because of the difference in temperature between the either sides of membrane rather than difference in electric potential, concentration or hydraulic pressure. Here the water to be purified is in direct contact with membrane. The pre-heated seawater or waste water is circulated through the membrane module and the membrane permeates only the water vapor to go through its pores. Condensation takes place at the farther side of the membrane due to the decrease in vapor pressure created by flow of cool tap water. Conventional desalination technologies such as reverse osmosis and multi-stage flash distillation are expensive and highly energy consuming. But, MD operates at comparatively lower temperatures (30–70o C) and ambient pressure. Compared to other desalination methods, it is a highly versatile and compact process, easy to maintain and eco-friendly. Moreover the scalability, inexpensive plastic materials for the installation and theoretically 100 percent salt rejection makes MD an attractive desalination process.

Before 1970’s, recording of sounds and images was done by using magnetic tape. After that, a paradigm shift happened when a new technology called optical recording has been invented. The advantage of storing the data using optical recording over magnetic tape is that, it offers a large storage space at comparatively less cost. One of the most advanced technologies which employ optical recording is the Holographic data storage. When laser beams fall on the object, the light reflected from the object will produce an interference pattern and this will produce a diffraction grating in the film used. These gratings diffract the light and thus forms a nice 3D image of the object recorded. Some of the polymers used in optical recording are PolyVinylalcohol, Polyvinylcarbazole (PVK), Polymethyl methacrylate (PMMA), Polaroid Photopolymer etc.

Polyvinyl alcohol is one of the oldest hologram recording polymers. The pictures are recorded in the PVA film by heating. One of the advantages of PVA film is that it can be easily coated. Dyes like methylene blue and Rose Bengal are used to sensitize the PVA.

PVK is another member of polymer family which can be used as a recording material and it can be sensitized using a myriad of dyes such as azo dyes, Ketocowmarin etc. Aqueous solution of PVK is not possible because it is insoluble in water. So one advantage is that it can be used in places where water resistant property is needed.

PMMA is another hologram recording polymer known for its best optical efficiency. It is amorphous and polar. Nitrocellulose, parabenzaquinone, spiropyran etc can be used as sensitizers.
## International Plastics Events

**Current & Upcoming Trade Shows and Trade Events for Plastic & Plastic Products**

<table>
<thead>
<tr>
<th>Event</th>
<th>Location</th>
<th>Dates</th>
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<tbody>
<tr>
<td>Polymer Club 2014 Fall symposium</td>
<td>Warwick, U.K.</td>
<td>Dec 17, 2015</td>
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<tr>
<td></td>
<td>A symposium on applied chemistry, plastics, paints and synthetic materials.</td>
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<tr>
<td>SEPM 2016</td>
<td>Monastir, Tunisia</td>
<td>Mar 24-27, 2016</td>
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<td></td>
<td>Science and engineering of polymer materials 2016.</td>
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<tr>
<td>IWPRE</td>
<td>Hamburg, Germany</td>
<td>May 17-20, 2016</td>
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<td>International workshop on polymer reaction and engineering.</td>
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<tr>
<td>TEF 2016</td>
<td>Naples beach hotel, Italy</td>
<td>Feb 15-17, 2016</td>
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<td>The Executive forum – 18th signature conference for leaders of top plastics processing companies.</td>
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<tr>
<td>Polycondensation 2016 – 11th conference covering wide range of topics and showcasing of the most exciting fields of condensation polymer science and technology.</td>
<td>Moscow and St. Petersburg, Russia</td>
<td>Sep 11-15, 2016</td>
</tr>
<tr>
<td>ESOPS20- 20TH European Symposium on Polymer Spectroscopy.</td>
<td>Dresden, Germany</td>
<td>Sep 11-14, 2016</td>
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<tr>
<td>IRaP- International radiation and polymers symposium</td>
<td>Peninsula of Giens, France.</td>
<td>Sep 25-30, 2016</td>
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<tr>
<td></td>
<td>The symposium deals with a wide range of topics and effects of ionizing radiations on polymers.</td>
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</tbody>
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**Higher Institute For Plastics Fabrication**

7798 AlKharj Road,
New City Industry, Unit #1,
Riyadh 14331 - 3244
Facebook: HIPF2010
Twitter: HIPF2012

**Contact Details:**
Tel.: +966 11 498 9600, +966 11 498 9678
Fax: +966 11 498 9650
e-mail: info@hipf.edu.sa
www.hipf.edu.sa

**PLASTICS LINK**

*Your Link to the World of Plastics*

The establishment of HIPF aims to prepare Saudi youth to participate as skilled technicians in the booming plastics industry of the Kingdom and to develop the technical knowledge and skills of Saudi workforce towards localization of plastics fabrication technology.

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