Expanded Plastics, Polyurethane, Polyamide and Polyester Fibres

Introduction

Expanded plastics are also known as foamed plastics or cellular plastics. Expanded plastics can be flexible, semi flexible, semi rigid or rigid. They can also be thermoplastic or thermosetting and can exist as open celled or closed celled materials. Expanded plastics may be prepared from most synthetic and many natural polymers. Most of the industrially important ones are made from polystyrene, polyvinyl chloride, polyurethanes and polyethylene, as well as from resins that derive from phenol, epoxy, etc. Polyurethane (PUR and PU) is polymer composed of a chain of organic units joined by carbamate (urethane) links.
Polyurethane polymers are formed by combining two bi or higher functional monomers. One contains two or more isocyanate functional groups and the other contains two or more hydroxyl groups. More complicated monomers are also used.
Polyurethane (PUR and PU) is a polymer composed of organic units joined by carbamate (urethane) links. While most polyurethanes are thermosetting polymers that do not melt when heated, thermoplastic polyurethanes are also available.
Polyurethane polymers are traditionally and most commonly formed by reacting a di- or poly-isocyanate with a polyol. Both the isocyanates and polyols used to make polyurethanes contain, on average, two or more functional groups per molecule.

A polyamide is a macromolecule with repeating units linked by amide bonds.
Polyamides occur both naturally and artificially. Examples of naturally occurring polyamides are proteins, such as wool and silk. Artificially made polyamides can be made through step-growth polymerization or solid-phase synthesis yielding materials such as nylons, aramids, and sodium poly(aspartate). Synthetic polyamides are commonly used in textiles, automotive applications, carpets and sportswear due to their high durability and strength.
The transportation manufacturing industry is the major consumer, accounting for 35% of polyamide (PA) consumption.
Polyester is a category of polymers that contain the ester functional group in their main chain. As a specific material, it most commonly refers to a type called polyethylene terephthalate (PET). Polyesters include naturally occurring chemicals, such as in the cutin of plant cuticles, as well as synthetics through step-growth polymerization such as polybutyrate. Natural polyesters and a few synthetic ones are biodegradable, but most synthetic polyesters are not. This material is used very widely in clothing.
Market Outlook

Polyurethane Market is set for intensifying growth in end user industries and is expected to reach ~24.2 million tons by 2022, Strategic market of global Polyurethane market is expected to grow at ~5.8% CAGR during 2016-2022 Based on types, Polyurethane is segmented into rigid foam, flexible foam, adhesives & sealants, coatings, elastomers and other products.
Global Polyurethane (PU) Market size was projected at $51.6 billion for 2015 and is anticipated to generate revenue greater than $78 billion by end of forecast timeline.
India Polyurethane (PU) Market Size

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The polyurethane (PU) market size was USD 53.94 billion in 2015 and is projected to grow at a CAGR of 7% from 2016 to 2025. High demand for lightweight & durable materials from end-use industries such as furniture, construction, electronics & appliances, automotive, footwear & packaging has driven growth in recent years.
The global polyamide market was valued at USD 25.14 Billion in 2016 and is projected to reach USD 30.76 Billion by 2021, at a CAGR of 4.1% from 2016 to 2021. The Indian polyester market witnessed a demand growth of 14 per cent year-on-year (YoY) in the second quarter of FY17.
Polyester fiber has become the fiber of choice within the textile industry, owing to its physical properties, price, recyclability, and versatility, which offer a unique set of advantages unmatched by any other fiber. Since 1990, overall demand for polyester fibers has grown at a sustained rate of nearly 7% per year globally. The polyester fiber market accounts for about half of the total global fiber market.
In 2016, total demand for polyester fibers is dominated by polyester yarn, which accounts for about 68% of overall consumption (with textile filaments having the greatest share of the yarn segment).
Global Consumption of Polyester Fibres
1. Polyepoxides and Epoxy Resins

- Epoxy Curing System, Background, Process Conditions, Polyether Polyols with Epoxy Resins, Highlights of the Technological Achievement, Laminates Comprising a Hard Foam Layer and a Fiber-reinforced Synthetic Resin Layer, Highlights of the Technological Achievement, Process Conditions, Plastic Deformation, Modification of Amino Polyols with Epoxy Resins
2. Polyamides and Polyimides

- Polyamides, High Impact Polyamides, Highlights of the Technological Achievement, Background, Process Conditions, Flameproof Polyamide Molding Compositions, Linear, Flexible, High Tensile Strength Copolyamides, POLYIMIDES, Fire-Retardant Imide Copolymers, Closed Cell Polyimides
3. Polyesters

- Producing Expanded and Cured Polyester Resin, Foamed Unsaturated Polyester Resins with Gel Coat, Crosslinked Polyester, Unsaturated Polyester Compositions with High Impact Strength, Foam Crystallization Of Condensation Polymers, Acrylate Rubber Modification of Aromatic Polyesters
4. Processing

Semi-Rigid and Flexible Polyurethane Foams from Guanidine and Thiourea Catalysts, Co-Catalyst, N,N,NTM,N-Tetramethyl-a,w-Polymethylenediamines as Catalysts, Foam Preparation Methods, Polyol R, Flexible Foam Preparation, Rigid Foam Preparation, Experimental Results, Evaluation, Catalyst System for RIM Elastomers, Preferred Embodiment, Flexible and Rigid Foams, Flexible Polyurethane Foam Prepared from a Reaction Mixture Which Includes a Polyether Triol, High Resilience Polyurethane Foam, Flexible Polyurethane Foams with Improved Thermal and Oxidative Stability, Siloxane Copolymer Mixtures in High Resilience Polyurethane Foam,
Rigid Shrink Stable Polyurethane Foam Derived from an Adduct of an Alkylene Oxide, Rigid and Semiflexible Polyurethane Foams Produced with Phenol-Aldehyde-Amine Resins, Flexible Foams with High Resiliency, Imparting Special Properties, Carbamylbiuret-Modified Polyisocyanates, Antistatic Polyurethane Foams, Surface Resistances at 25% Relative Humidity and 23Â°C of Polyurethane Foams, Dispersible Vinylidene Chloride Polymer Microgel Powders as Additives for Polyurethane Foam, Reducing the Molecular Weights of Polyurethane Polymers to Desired Levels in Polyurethane Foam from an Oxyalkylated Product,
Polyurethane Foam Prepared from a Copolymer/Polyol Composition, Molding, Preparing Foams with Internal Mold-Release Agents, Molding a Rigid Integral Skin Foamed Resin Product, Biomasses, Enzymes and Polypeptides, Polyurethane Containing Polypeptides, Polyurethane Plastics in Which Polyisocyanates Are Reacted with Reactive Organic Fillers Comprising Biomasses, Preparation and Use of Enzymes Bound to Polyurethane, Reclamation of Products, Reclaiming Polyurethane Foam, Polyol Recovery from Polyurethane Foam Comprising Alcohol and Steam Hydrolysis, Formulation of Flexible Polyurethane Foam, Applications, Reinforced Foamed Resin Structural Material,
Polyurethane Binders, Polyurea Polyurethane Foamed Sponge with High Wet Strength, Odorant Hydrophilic Foam Compositions, Articles Coated with a Crushed Foam, Bonding Polyurethane Sheeting to Acrylic or Polyurethane Sheeting in Production of Transparent Windows, Forming a Layer of Blown Cellular Polyurethane on a Carpet Backing, Reinforced Polyurethane Foams, Reaction Injection Molded Polyurethane, Making Castings of Thermosetting Polyurethane Materials, Comparison, Water Skis Having a Reinforced, Foamed-in-Place, Plastic Hull Bonded to an Aluminum Deck
5. Polyolefins

- Processing, Ethylenic Polymer Foams Having Improved Dimensional Stability, Crosslinking/Foaming of Low Density Polyethylene Using Linear Peroxyketalts, Foaming Synthetic Resin Compositions Stabilized with Certain Higher Ethers, Esters or Anhydrides, Polyolefin Foam with Small Uniform Cell Size, Preferred Embodiment and Comparative Example, Continuous Production of Foamed Polyethylene Films, Reducing the Aging Period of Polyethylene Foams, Crosslinked Chlorinated Polyethylene Foam, Applications, Fire-Retardant Anhydride Copolymers, Foamable Copolymers, Closed Cell Foamed Films and Sheets
6. Types of Polyamide Compositions

7. Polycondensation

8. Fiber Production

9. Integrated Polyester Production Processes

- Du Pont, Fiber Industries, Goodyear Tire and Rubber, Monsanto, Werner & Pfleiderer

10. Prepolymer Production

- Reactor Design and Operation, Du Pont, Eastman Kodak, Inventa AG, Mobil Oil, Monsanto, Teijin Ltd., VEB Chemiefaserwerk "Friedrich Engels", Vickers-Zimmer AG

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11. Fiber Production Process

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