WHAT ARE POLYURETHANES?

Over two million tonnes of polyurethane raw materials are produced every year in Europe alone.

In monetary terms this equates to some five billion euro (5.5 billion US dollars).

More than 15,000 European companies are involved in the manufacturing of polyurethanes.

Over two million Europeans work with polyurethanes.

Every automotive-manufacturer, every refrigerator-producer, every sport-shoe producer, furniture makers, and countless other international brands, depend on polyurethanes.

Polyurethanes are made from two basic raw materials: polyols and diisocyanates. A key advantage of polyurethanes is that specific parts and combinations of each chemical group can be chosen to create the desired end product.

Following the principles of Responsible Care, the diisocyanates industry, represented by the European Isocyanate Producers Association (ISOPA), concentrates on health, safety and environmental concerns. ISOPA has developed guidelines emphasising the responsible management of diisocyanates throughout their entire life-cycle, from raw materials production through manufacture, distribution and disposal of end product.

Polyurethanes are an essential part of modern life. Used as insulation material in construction or in domestic appliances, polyurethanes offer environmental benefits: they save energy by reducing the amount of fossil fuel needed to heat or cool the building, or power the appliance. Meanwhile, the lightness of polyurethanes enable us to produce lighter and, therefore, more energy-efficient cars.

Cover picture: rebonded flexible foam used in various cushion applications.
All around us,

throughout the world, polyurethanes improve our lives by providing comfort, safety and environmentally sustainable products.

Polyurethanes are the most versatile group of plastics, which make them ideal for a wide range of applications: they are stronger, lighter and easier to use than many traditional materials. They are also more durable and do not rot or corrode.

At the end of their life-span, polyurethane insulation materials can be recycled or its energy can be recovered in properly equipped power-generation facilities.
CONSTRUCTION

Polyurethane foam is used extensively in the construction industry. It is the most effective insulation material available. In residential housing, polyurethane foams insulate roofs, wall cavities and floors.

Other benefits such as structural strength, water-vapour resistance, durability, space-saving and lightness, make rigid polyurethane composite panels a popular material for commercial buildings, such as warehouses and cold stores. Polyurethanes allow cold stores to be built without heat-bridges. Because the foam is extremely durable, it also extends the life-span of a building.

Excellent structural strength characteristics and high resistance to wind forces and roof applications mean there is minimal need for additional mechanical reinforcement. The lightness of polyurethane building materials helps minimise transportation costs and makes construction easier and safer for builders.

Effective insulation is essential in reducing fuel and energy costs. Current efforts to control global warming emphasise the need for energy conservation. Industry experts estimate that worldwide insulation of buildings to optimum standards could reduce global energy requirements by more than 10 per cent.

Thanks to their excellent insulation properties, polyurethanes play a key role in creating energy-saving solutions, and contribute significantly to the European Union’s target of eight percent reduction in greenhouse gases. This meets targets which were agreed at the world climate change conference in Kyoto in December, 1997.

AUTOMOTIVE

Polyurethanes are the ideal material for the automotive market because they provide safety and comfort to drivers and their passengers. Polyurethane foam makes strong and comfortable car seats which ensures safety in case of collision. The excellent sound-absorbing and vibration-reducing qualities of polyurethanes also contribute to higher comfort and safety levels. Polyurethane sound insulation can reduce vehicle noise by more than 50 per cent in comparison with traditional insulation materials such as bitumen sheet or felt fibre.
Polyurethane applications help lower the environmental impact of cars by reducing vehicle weight. This leads to increased fuel efficiency and lowers emission levels. The precision with which they are made ensures minimum materials are wasted and parts made of polyurethanes can be recycled.

The versatility of polyurethanes creates important economic benefits. Polyurethanes enable cost-effective production, minimum scrap material and lower overall vehicle costs. Because polyurethanes are not prone to corrosion, they significantly extend the lifetime of a car.

**FOOTWEAR**

Footwear manufacturers choose polyurethanes as the most versatile shoe-sole component for the industry. Polyurethanes provide both designers and manufacturers with the potential to create unique designs, cost effective and high quality products, and provide comfort from sports-shoes to high fashion footwear. Polyurethanes out perform alternative materials in terms of comfort, abrasion resistance and durability. These attributes help save costs and raw materials.

**APPLIANCES**

Rigid polyurethane foam provides effective insulation for food conservation in the home. It is the most efficient insulant for reducing energy consumption in refrigeration. The combination of excellent insulation and mechanical properties allows avoidance of heat-bridges. Modern refrigerators and freezers insulated with polyurethane foam are smaller and lighter than their predecessors. They also provide superior performance and have more storage space.

Better insulation has increased the efficiency of refrigerator energy consumption over the last decade and is expected to do even more in the next century with use of effective insulation methods.

**FURNITURE**

Due to its unique properties and behaviour, flexible polyurethane foam has established a leading position as a primary filler for seating cushions and mattress cores. Tailor-made to suit the requirements of consumers, polyurethane foams combine comfort, softness and durability.

Foam comes in a range of densities and hardness, moulds and shapes which adapt perfectly to the shape of the human body and therefore ensure good support.
Hygiene is an important issue, particularly for mattresses and pillows: polyurethane flexible foam does not support the growth of micro-organisms and is recommended for use in hospitals. Materials that support the body should be able to absorb humidity. This is particularly true for mattresses, because a human body loses about a quarter of a litre of liquid overnight through perspiration. The open cellular structure of flexible foam allows excellent absorption of humidity, good ventilation and thermo-regulation.

**BINDERS**

The binding qualities of polyurethanes have opened new opportunities for re-using and recycling scrap materials. Using polyurethane resin as a glue, materials such as wood, rubber and other material particles can be bound together to make new high quality products for applications in construction, outdoor furniture and packaging. Polyurethane applications in this sector include high quality boards to make cupboards, work surfaces and floorings in kitchens. Similarly, rubber surfaces can be made from used car and truck tyres which are granulated and bonded to make safe and durable all-weather surfaces for sports tracks or soft surfaces for children’s playgrounds and gymnasias.

**COATINGS AND SEALANTS**

Polyurethane coatings are often used to create extra strong floors, which also provide a surface that is wear resistant, sound absorbent and easy to clean. Some polyurethanes are used intensively on steel and concrete structures to protect them from corrosion. Others are chosen for protecting wooden surfaces in house furniture. Polyurethane sealants are also used for sealing windows in buildings and cars because of excellent adhesive properties and resistance to harsh weather conditions. In the construction industry they are used in concrete expansion joints and as pre-formed gasket seals in piping.
ISOPA has produced a series of fact sheets on polyurethane recycling options - the following titles are available:

- PU in Perspective
- Densification/Grinding
- Rebonded Flexible Foam
- Adhesive Pressing/Particle Bonding
- Regrind/Powdering
- Compression Moulding
- Chemolysis
- Feedstock Recovery
- Energy Recovery
- Energy Recovery from Flexible PU Foams
- Recovery of Rigid Polyurethane Foam from Demolition Waste
- Options in Practice
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APME
(Association of Plastics Manufacturers in Europe)
and the European Polyurethane Industry Associations

BING
Federation of European Polyurethane Rigid Foam Associations

EUPUR
European Association of Flexible Polyurethane Foam Blocks Manufacturers

PANAMA INTERNATIONAL
An International Association of Sandwich Panel Manufacturers

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ISOPA, the European Isocyanate Producers Association - is a non-profit making organization operating as a sector group under the auspices of the European Chemical Industry Federation (CEFIC), adhering to the federation’s operational policies and codes of practice, including the Treaty of Rome. Its activities are supported by high level research, much of which is sponsored by the International Isocyanate Institute.

Since the original polyurethane material has not been designed for use in articles in contact with food, relevant EU (such as Directives 90/128/EEC) and national legislations need to be consulted, if and when recycled materials are used to manufacture articles and goods for possible direct and indirect food contact.

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