Technologies supporting polyurethane foams used in a wide variety of fields

SANYO PRODUCT TOPICS

Polyols for polyurethane foam, SANNIX products

Polyurethane foam is a sponge-like resin with bubbles called cells. It ranges from soft materials, like cushions (flexible), to hard materials, like insulation boards (rigid). Its hardness can be adjusted, and various functions can be added depending on the application.
We will introduce products that are used as raw materials for polyurethane foam, which is widely used in various fields.

Polyurethane Foam Produced by Resinization Reaction

Polyurethane is one of the resins produced by reacting compounds containing active hydrogen, such as polyols, as starting materials with polyisocyanate, a compound with a functional group called NCO, such as polyisocyanetes. This polyurethane is then foamed to create cells (bubbles) inside, resulting in a material known as polyurethane foam or urethane foam.
When polyol and polyisocyanate are reacted directly, it results in cell-free polyurethane resin. This reaction is called a resinification reaction.
Polyurethane resins are used in various applications such as shoe soles, synthetic leather, backpacks and other products made of polyurethane fibers, waterproof with rubber-like texture products such as athletic tracks etc., furniture, flooring and balconies, adhesives, sealants and other applications where film-foaming ability and adhesion are important.
During the resinification reaction, adding a foaming agent such as water causes a reaction between water and polyisocyanate, resulting in the generation of CO_2. This CO_2 then forms cells inside the resin. This process is called foaming reaction. Polyurethane foam is a porous resin that is formed by simultaneously undergoing both the resinification reaction and the foaming reaction.

The key to adjusting hardness is molecular length and the number of functional groups connecting molecules

Polyurethane foam is characterized by its ability to be adjusted to various hardness levels, from soft to hard. Therefore, it is used in various fields, including automobile interiors, furniture, bedding such as mattresses and pillows, clothing, and building materials. Among these, flexible polyurethane foam is the most commonly used in the automotive sector, accounting for more than half of all shipments in general, followed by significant usage in the bedding sector. The low rebound and high rebound functions often promoted in bedding are partly achieved by adjusting the hardness of the polyurethane foam.
The hardness of polyurethane foam is primarily determined by the length of the molecules and the number of functional groups linking the molecules. In the case of soft foam, the molecules are long and there are few functional groups linking them, resulting in a large degree of stretchability and a soft foam. On the other hand, in the case of hard foam, the molecules are shorter, and many functional groups are connected, leading to a rigid foam. The molecular length and the number of functional groups required to achieve such differences in hardness are achieved through the molecular design and formulation design of the raw materials used.
Among polyurethane foam raw materials, polypropylene glycol (PPG/ one type of polyether polyol), which is produced by adding alkylene oxides such as propylene oxide (PO) and ethylene oxide (EO) to starting materials with active hydrogen, such as alcohols through high-pressure polymerization, is widely utilized. Because it can be designed with a wide range of variations in terms of the type of starting materials, the number of active hydrogens related to the number of functional groups, the number of AOs added, the addition positions, and their sequences.
Sanyo Chemical's "SANNIX" series is a typical example of this category, widely used by most polyurethane foam manufacturers in Japan and extensively utilized overseas.

A product developed through the introduction of technology from the United States

Sanyo Chemical released the first Japanese-made PPG for polyurethane in 1960 under the name "SANNIX." One of the triggers was the acquisition of high-pressure polymerization technology learned from the United States in 1955, initially aimed at producing EO adducts that could be used as emulsifiers in pesticides.
In 1959, Sanyo Chemical Industries received information that PPG was utilized as a raw material for urethane foam in the United States. At the same time that the petrochemical industry was beginning to expand in Japan. Anticipating the future demand, Sanyo Chemical began development with the aim of becoming a pioneer in polyol in Japan.
In the same year, alongside the development of polyols processes, Sanyo Chemical invested nearly double the amount of its previous capital into constructing a production facility for PPG utilizing the high-pressure polymerization

technology learned in the United States. However, the development was not a simple process, and after overcoming repeated failures and hardships at every stage from research to manufacturing to commercialization, we finally succeeded in commercializing PPG in 1960. From the following year, 1961, we began data based technical sales. Initially, bedding mattress foam was the mainstream, but our business expanded into various fields, and the "SANNIX" series is now one of the core businesses of Sanyo Chemical Industries. Data-driven technical sales refers to a sales method that utilizes chemical data and other information to sell products.

New Mid-Term Business Plan 2025 is underway

Currently, the polyurethane foam industry is gaining momentum for environmentally friendly development, such as recycling and the use of biomass materials. Additionally, there is an increasing demand for product enhancements that contribute to improving quality of life, such as the addition of odor-neutralizing features in bedding. In response to these changes of the times, Sanyo Chemical has also set the resolution of social issues such as reduction of environmental burden and improvement of quality of life as a basic policy in its new Mid-term Business Plan 2025, and is promoting development of environmentally friendly and value-added products in the polyurethane business. At the same time, we are promoting Monodukuri Transformation (Transformation in Production & Supply Chain), which includes improving production processes, increasing efficiency throughout the supply chain, including reviewing raw materials and their suppliers, and reducing CO_2 emissions in the production process. Polyurethane foams, widely utilized across various fields, play diverse roles in terms of the SDGs. Going forward, we will continue to innovate in product development and activities aimed at reducing our environmental impact.

■SANNIX Series Applications by Starting Material Composition

<table>
<tr><th rowspan="2">Starting Material Composition</th><th rowspan="2">SANNIX products</th><th colspan="2">Polyurethane foam</th><th>Non-foam polyurethane</th></tr>
<tr><th>Flexible foam</th><th>Rigid to semi-rigid foam</th><th>Paints, adhesives, sealants, elastomers</th></tr>
<tr><td>Diol-based</td><td>PP, PA</td><td rowspan="5">Automobile seat cushions and furniture</td><td>–</td><td rowspan="5">Waterproofing materials, paints, sealants, flooring materials, adhesives, rubber for belts and shoe soles, etc.</td></tr>
<tr><td>Glycerol-based</td><td>GP, GA, GH</td><td rowspan="6">Insulation for refrigerators, building materials, mattress cores, etc.</td></tr>
<tr><td>Trimethylolpropane-based</td><td>TP</td></tr>
<tr><td>Aliphatic amine-based</td><td>AP, NE, NL, NP</td></tr>
<tr><td>Pentaerythritol-based</td><td>HD, EP</td></tr>
<tr><td>Aromatic amine-based</td><td>HM</td><td>–</td><td>–</td></tr>
<tr><td>Sorbitol-based</td><td>SP</td><td>–</td><td>–</td></tr>
<tr><td>Sucrose-based</td><td>HS</td><td>–</td><td>–</td></tr>
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In addition, we offer various polyether polyols and polymer polyols for adjusting physical properties, such as SANNIX FA and KC. The examples listed above are representative, and we propose formulations tailored to specific needs by adjusting parameters such as the number of PO and EO additions, their positions, and the structure of starting materials.

Please contact our company sales representative when handling our company products.
Also be sure to read the "Safety Data Sheet" (SDS) in advance.
It is the responsibility of the user to determine the suitability and safety in the intended use.