

Polyiso and Polyurethane: What is the Difference?

About Polyiso Insulation

Polyiso is a rigid foam insulation used in more than 70% of commercial roof construction and offers a continuous insulation solution for commercial and residential wall assemblies. As one of North America's most widely used and readily available building products, Polyiso is a cost-effective insulation option for reducing building energy use and improving the overall service-life of roofs and walls.

The benefits of using Polyiso include:

- High R-value per inch of thickness
- Excellent fire test performance
- Extensive building code approvals
- Cost-effective continuous insulation (ci) solution
- Compatible with most roof and wall systems
- Dimensional stability
- Compressive strength
- Moisture resistance
- Thinner walls and roofs with shorter fasteners
- Long service life
- Preferred insurance ratings
- Virtually no global warming potential
- Zero ozone depletion potential
- Recyclable through reuse
- Recycled content (amount varies by product)
- Regional materials (nationwide production network)

History

Polyurethanes comprise a broad class of products that includes building insulation, flexible foam used in the automotive and furniture industries as well as coatings that enhance the durability and appearance of other products. First developed in the 1930's by Prof. Dr. Otto Bayer, polyurethanes were initially used in military applications during the WWII era. In the 1950's, the versatility of polyurethanes drove the development of other applications in consumer, industrial and aerospace industries. Beginning in the 1970's as the demand for energy efficiency increased, polyurethane chemistries were used to develop popular insulation technologies to insulate homes and buildings as well as enhance the efficiency of appliances in the refrigeration industry.

Today's Building and Construction Market

Polyurethane chemistry is widely used in building and construction, and is perhaps most recognized for its use in manufacturing rigid polyisocyanurate insulation and spray polyurethane foam. Both technologies are used in residential and commercial construction to insulate the building envelope and mechanical systems¹. Rigid polyisocyanurate (or polyiso) insulation is the most popular option for insulating low-slope roof systems. First developed and used in the 1970's, polyiso insulation delivers exceptional thermal and fire performance. The product's enhanced fire performance led to early success and adoption by the roofing industry because polyiso can be installed in steel deck roof systems without the use of an additional thermal barrier such as gypsum board.

What is the Difference Between Polyiso and Polyurethane Chemistries?

To start, a simple chemistry lesson is needed. Polyurethanes are produced by a chemical reaction between the polyol and the isocyanate. This reaction must be carefully controlled and special recipes (containing the polyol, isocyanate, blowing agent, catalysts, surfactants and flame retardant) are developed for each product type and application. The amount of polyol and isocyanate is matched according to a chemical equivalent weight. For a standard polyurethane foam, the amount of isocyanate used is typically about 105% of that needed to exactly match the chemical equivalent of the polyol. A foam made with this recipe is said to have an index of 105.

1. Source: National Roofing Contractors Association's annual market surveys.



Surround yourself with the best.

Comparatively, polyiso is made using a greater ratio of the isocyanate to the polyol. In theory, polyiso can be produced using only isocyanate, blowing agent, catalysts, surfactants and flame retardant. In this reaction scenario, the isocyanate reacts with itself to form a highly crosslinked thermoset polymer with a ring-like structure. To manufacture polyiso insulation, polyol is used to modify this “pure” polyisocyanurate chemistry. This creates a product with chemical bonds that exhibit inherent fire resistance and strength. Compared to a standard polyurethane recipe with an index of 105, the index of a typical polyiso insulation product used for roofing is about 250. This means that the amount of isocyanate is 250% of that needed to react with any polyol used.

Today’s Polyiso Foam Insulation Products

Polyiso foam insulation products used today in roofing and building envelope applications are a mixture of polyurethane and polyisocyanurate chemistries. This provides the advantages of both chemistries resulting in rigid insulation boards that deliver superior R-value per inch, excellent performance in code required fire tests, and compatibility with most roofing and wall assembly systems. With respect to fire performance, polyiso (and polyurethane) foam insulation is a thermoset plastic. This means that polyiso products do not melt or drip when exposed to high temperatures making the products ideal for construction applications where fire resistance is necessary.

For more information on polyiso products, applications and the manufacturing process used to produce this industry-leading insulation, please visit www.polyiso.org.

ABOUT PIMA

Since 1987, PIMA has served as the voice of the North American rigid polyiso insulation industry. PIMA is a leading advocate for safe, cost-effective, sustainable, and energy-efficient construction. The Association is comprised of polyiso manufacturers and industry suppliers, and represents the public policy interests of its membership at the local, national, and international levels to advance high-performance building practices.

PIMA produces technical bulletins to address key topics related to polyiso insulation. These publications inform architects, specifiers, and contractors about the performance characteristics of polyiso insulation. Always consult individual manufacturers for product specific information, including product data sheets and installation instructions.

For more information on polyisocyanurate insulation, visit www.polyiso.org

