

Polyurethane and Polyiso: 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)
- QualityMark^{CM} certified LTRR-values

Background

Polyurethane plastics, originally developed in the 1930s, were primarily used in military and aerospace applications until the 1950s. Their application in consumer and industrial products became popular in the late 1950s, when they were used mostly for cushioning (flexible foam), coatings (polyurethane modified oil based), and thermal insulation applications (rigid foam). In the 1970s, there was a growth in the use of rigid polyurethane (PUR for short) foam thermal insulation in refrigerators and panel products, and in spray applied foam as building insulation.

Typically, roof systems containing rigid polyurethane roof insulation needed a thermal barrier such as perlite or gypsum board to pass the rigorous Factory Mutual Calorimeter fire test (FM 4450). Development of new chemical recipes and catalysts in Europe and in the United States resulted in a next generation product called polyisocyanurate foam (PIR for short), or polyiso. Polyiso foam first appeared on the US market in the late 1970s. A major advantage of polyiso foam was its ability to pass the FM Calorimeter fire test without a thermal barrier.

What are the Differences Between Rigid Polyurethane and Rigid Polyiso Foams Today?

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

Theoretically, polyisocyanurates can be produced with no polyol, using only isocyanate and catalysts - blowing agents and surfactants. Instead of reacting with the polyol, the isocyanate reacts with itself to form a highly crosslinked thermosetting polymer with a ring-like structure. For commercial polyiso foam, the polyurethane is modified with polyisocyanurate, creating superior fire resistance and maintaining toughness. The index of polyiso foam roof insulation products today is about 250. This means that the amount of isocyanate is 250% of that needed to react with any polyol used; the extra 150% makes polyisocyanurate and minor amounts of other polymers.



Surround yourself with the best.

What Exactly is Polyiso Foam Insulation?

Today's polyiso products are a mixture of rigid polyurethane and polyisocyanurate, with the advantages of both products. Sometimes, they are referred to as PUR/PIR foams. These products deliver superior R-value per inch, excellent performance in code required fire tests, and compatibility with most roofing and sheathing systems.

Polyiso insulation is produced with facers that are tailored to match end use. For example, foil faced polyiso is most commonly used as wall sheathing in residential construction or in masonry cavity wall construction. Roof applications rely on glass fiber facers or glass fiber reinforced organic felt facers.

PUR/PIR foams are thermoset plastics, which means they do not melt and flow when exposed to high temperatures. This makes these products ideal for construction applications where fire resistance is necessary. Polyiso foam insulation products are used in both commercial and residential buildings as thermal insulation in roof and wall systems.

Polyiso insulation products are easy to specify. These products meet the requirements of ASTM C1289 Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board and CAN/ULC-S704 Standard for Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced.

PIMA

For more than 30 years, PIMA (Polyisocyanurate Insulation Manufacturers Association) has served as the unified voice of the rigid polyiso industry proactively advocating for safe, cost-effective, sustainable and energy-efficient construction. PIMA's membership includes manufacturers of polyiso insulation and suppliers to the industry. The products of PIMA's members comprise the majority of the polyiso produced in North America.

PIMA produces technical bulletins to address frequently asked questions about polyiso insulation. These publications update and inform architects, specifiers, and contractors about and build consensus on the performance characteristics of polyiso insulation. Individual companies can provide specific information about their respective polyiso products.

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



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