BASF
Polyurethanes (PU)
Rigid Foam
Creating a Greener Future for Building Insulation
BASF Polyurethanes (PU) Rigid Foam

Climate Change – a Challenge for the World and China

As one of our era’s most significant challenges, global warming is affecting us all.

Being the world’s second largest consumer of energy, China has made energy saving one of its top priorities. Tackling this problem has become even more urgent, given the substantial impact of the country’s fast-growing market and industries on its domestic energy resources.

More efficient utilization of limited energy resources has now become a major national policy set out in the 11th Five-year Plan. Under the directive of State Council, 65% improvement on energy efficiency improvement was targeted for the construction sector in key cities and 50% energy saving for the rest of cities and provinces.

As a chemical leader, and a member of the China Polyurethane Industry Association (CPUIA), BASF has contributed to a special task force sponsored by the Ministry of Housing and Urban-Rural Development to revise the building insulation code and practices to embrace energy efficiency and conservation in buildings. Published in 2007, the report recommends the use of environmentally friendly insulation materials in buildings, such as polyurethane rigid foam, to support the country’s sustainability drive.

Cutting-edge Solution for Energy Conservation:

BASF Polyurethanes (PU) Rigid Foam

BASF’s products, technologies and services help customers save energy and resources. This, in turn, has enabled them to help product end-users to generate similar savings.

One category of such products are insulating materials developed by BASF for insulating buildings to cut down on the use of heating oil by as much as a third of that required in older architecture. BASF PU rigid foam is an example of a cutting-edge product in building insulation.

PU basically consists of two raw materials, isocyanate and polyol, which are obtained from crude oil. Technically, it involves mixing two components to create a chemical reaction.

BASF Polyurethanes recommends the use of zero ODP (Ozone Depleting Potential) substances as blowing agents for polyurethane foam to yield double benefits: First, the process does not damage the earth’s protective ozone layer. Secondly, it can mould the PU material into any shape to meet product development requirements.

The main forms of PU in building and construction include sandwich panel, spray foam, wall and roof insulation board, wood binder and elastomers for window thermal barrier.

Key Product Benefits:

Superior Insulation Performance

- A preferred material for insulation in the construction industry, BASF PU rigid foam outperforms other types of insulation materials, with an R-rating of 6.7 per inch.
- PU spray foam produces a seamless insulating layout with no joints or gaps, hence controlling air leakage and reducing drafts and noise between floors and walls. At the same time, it reduces energy loss due to thermal bridging.
• Increases the strength of composite building materials.
• Resistant to moisture, mold, mildew and insects.
• Durable, with a long life cycle.

Fire-resistance

• As the fire-retarding reaction of polyurethane depends on its shape and chemical composition, PU foam can be formulated to significantly increase its fire-resistant properties, enabling the building material to meet fire safety standards.

Process Efficiencies

• PU is foamed-in-place for reduced material waste, improved productivity in manufacturing.
• Adheres well to various substrates, eliminating the need for adhesives.
• PU rigid foam system can be processed through Autofroth™ SL or conventional PU processing equipment.
• Can be applied directly to the existing substrate in 95% of retrofit cases, thus eliminating the cost of tear-off, reducing the amount of waste generated as well as limiting interior exposure and downtime.

Design Flexibility

• Customized formulations meet building codes and other customer requirements.
• Foams can be molded into a wide range of shapes and sizes and even areas with poor accessibility can be insulated.

Cost Efficiency

• As poorly insulated buildings are very expensive in terms of wasted energy, using BASF PU rigid foam will help cut energy bills substantially.
• Compared with conventional methods, roof sealing with Elastospray™ CH foam system generates time savings of up to 80% and reduce cost by as much as 50%. An experienced processing team can cover more than 1,000 m² of roof surface per day with one machine under favorable conditions.

Energy Savings and Environmental Protection

• Enhanced energy efficiency and thermal performance allow for the downsizing of HVAC (heating, ventilating and air-conditioning) equipment, thereby saving energy and helping to reduce CO₂ emissions.
Typical Applications of BASF Polyurethanes (PU) Rigid Foam in Building Construction

BASF PU rigid foam can be applied on different building parts and components for internal or external insulation, to save energy, ensure a comfortable living climate and reduce cost for heating and cooling. Due to its superb performance, it is increasingly used in various segments of construction industry, including residential and commercial buildings, warehouses, factories, supermarkets and stadiums. PU rigid foam is also the preferred material for the insulation of hot water tanks as well as for district heating/cooling pipes.

<table>
<thead>
<tr>
<th>Building part / Component</th>
<th>Benefits</th>
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<tbody>
<tr>
<td>1 Building shells / facades</td>
<td>Elastopor™ CH and Elastopor™ CH rigid foams are applied as the core material of metal-faced sandwich panels, which can be used as building facades and roof elements in commercial and industrial buildings, including cold storage construction.</td>
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<tr>
<td>2 Pitched roofs</td>
<td>Elastospray™ CH PU spray foam provides an airtight, seamless and weather resistant thermal barrier, with superior thermal protection, suitable for pitched roofs. Due to its effectiveness in thin layers, PU insulation takes up far less space than any other insulants.</td>
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<tr>
<td>3 Flat roofs</td>
<td>Superior insulating and air barrier properties of Elastospray™ CH PU spray foam help increase building energy efficiency by providing flat roofs with superb thermal protection. The material combines a high level of resistance and dimensional stability adequate to withstand temperatures arising from solar radiation.</td>
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<tr>
<td>4 Wall insulation</td>
<td>Elastospray™ CH insulating material is easy to apply on the external wall using the spray foam process which provides an airtight, seamless and weather resistant thermal barrier. Sandwich panel or foam board using Elastopor™ CH or Elastopor™ CH can also be used. As a result, thermal insulation effectiveness can be improved by 60% as a result.</td>
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<tr>
<td>5 Flooring</td>
<td>Heat loss from the floorings can be reduced with the use of Elastospray™ CH PU spray system or Elastopor™ CH rigid foam, whose insulation elements can be combined with flexible coatings for superior floor insulation.</td>
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<tr>
<td>6 Windows + Doors</td>
<td>Elasturan® Polyurethane based window thermal barriers act to eliminate the transfer of outside climatic conditions into a building interior, with reduced condensation as an added benefit. This helps to conserve a building's interior temperatures, hence reducing the energy needed for either heating in winter or cooling during summer. In addition to making doors stronger and more durable, Elastopor™ CH rigid foam also add significant insulation value reducing energy costs as well as dampening noise during operation.</td>
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Case Study: Renovation of a Four-Storey Building in Hongkou, Shanghai, with Spray Foam

Following a comprehensive makeover using Elastospray™ CH spray foam system, a four-storey building has achieved about 50% savings in heat energy usage, with a significant reduction of carbon dioxide emissions by 21.6 kg/m² (please see table below). This makeover project provides an illuminating example of how BASF spray-foam system outperforms traditional building insulation and air barrier combinations.

Equally, it shows that other buildings in Shanghai and in fact, across the whole of China, can achieve a similarly high level of energy efficiency, in line with the state’s directives on scaling down energy intensity and CO₂ emissions.

<table>
<thead>
<tr>
<th></th>
<th>Before renovation</th>
<th>After renovation</th>
<th>Benefits</th>
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</thead>
<tbody>
<tr>
<td>Exterior Wall</td>
<td>K-factor = 1.91 W/m² a</td>
<td>K-factor = 0.62 W/m² a</td>
<td>Improvement of 68%</td>
</tr>
<tr>
<td>25mm PU spray foam</td>
<td></td>
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<tr>
<td>Roof</td>
<td>K-factor = 3.47 W/m² a</td>
<td>K-factor = 0.42 W/m² a</td>
<td>Improvement of 88%</td>
</tr>
<tr>
<td>50mm PU spray foam</td>
<td></td>
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</tr>
<tr>
<td>Energy Consumption</td>
<td>60.91 kWh/m² a</td>
<td>31.82 kWh/m² a</td>
<td>Heat energy saving ≈ 50%</td>
</tr>
<tr>
<td></td>
<td>6.1 litre oil/m² a</td>
<td>3.2 litre oil/m² a</td>
<td>Reduction of CO₂ emissions: 21.6 kg/m² a</td>
</tr>
<tr>
<td></td>
<td>45.1 kgCO₂/m² a</td>
<td>23.5 kgCO₂/m² a</td>
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Reasons for Using PU Rigid Foam Systems from BASF

**Strong technical know-how:**
BASF has been developing new generations of PU rigid foam systems to address ever more stringent customer and regulatory demands for a higher level of functionality and ecological performance. In fact, we have been engaging architects, builders and homeowners internationally to explore energy-efficient building material options and to consider utilizing technologies that have greater sustainable energy efficiency solutions.

Regional Technical R&D Center in Shanghai will serve as an incubation facility for new PU applications within the construction sector and provide tailor-made technical support for customers across entire China.

**Reliable product supply:**
As a leading supplier of PU basic raw materials, systems and specialties in the industry, BASF guarantees a reliable supply of raw materials and products at a consistently high quality.

**Proximity to customers from China and in the Asia Pacific region:**
With its comprehensive network of system houses in China and the rest of Asia, BASF is able to provide customers with tailor-made formulations and on site training or to assist them through various innovative solutions.

**Corporate commitment to climate protection:**
Investing in a range of measures for climate protection, BASF intends to reduce its specific greenhouse gas emissions per metric ton of sales product by 25 per cent by 2020, compared with 2002. The energy efficiency of the production processes will also be increased by a further 25% over the same period.

The data contained in this publication is based on our current knowledge and experience. In view of the many factors that may affect processing and application of our product, this data does not relieve processors from carrying out their own investigations and tests; neither does this data imply any guarantee of certain properties, or the suitability of the product for a specific purpose. Any descriptions, drawings, photographs, data, proportions, weights etc. given herein may change without prior notice and do not constitute the agreed contractual quality of the product. It is the responsibility of the recipient of our products to ensure that any proprietary rights and existing laws and legislation are observed.
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BASF Polyurethanes (PU) Rigid Foam sustainability drive. such as polyurethane rigid foam, to support the country’s

...and specialties in the industry, BASF guarantees a reliable product supply:

- Process Efficiencies:
  - Energy savings
  - Emissions reduction

- Cost Efficiency:
  - Energy bills substantially

- Key Product Benefits:
  - Increases thermal barrier. Sandwich panel or foam board using Elastopor™ CH PU spray foam
  - Durable, with a long life cycle.

- Process does not damage the earth’s protective ozone layer.

- One category of such products are insulating materials, with an R-rating of 6.7 per inch.

- PU basically consists of two raw materials, isocyanate and...