

## Flying High with 3M™ Glass Bubbles

### REHAU and 3M collaborate on lightweight polymer system for interior aircraft components

Seasoned travelers know the importance of packing light. This adage echoes especially loudly through airport hallways, departure gates and baggage claim areas – because in air travel, every ounce counts. The more an aircraft weighs, the more fuel it consumes, and no one is more keenly aware of this than the airlines themselves. They are on a constant search for materials to help alleviate the heavy burdens of demanding fuel economy regulations . . . concern for the environment . . . and, above all, soaring oil prices.

Although no specific standards have yet been defined for aviation, the International Air Transport Association (IATA) has taken the initiative to work with the aviation industry to define a timeline for achieving carbon neutral growth and, ultimately, an industry whose carbon contribution to the atmosphere is a net zero. (Source: “The IATA Technology Roadmap Report,” issued June 2008.)

#### Lighter polymers for lighter planes

REHAU, a global polymer processing firm, is working with 3M to help lighten the load and work toward carbon neutral solutions. Since its establishment in 1948, REHAU has been a leader in innovative polymer-based materials for construction, automotive, and industries from furniture and appliance to transportation. It seems only natural that REHAU and 3M, both companies long committed to sustainability, should join forces to produce materials that enable more efficient use of resources.



Handrail made from RAU-FLIGHT, REHAU's proprietary lightweight PEI resin system containing 3M™ Glass Bubbles.

Several years ago, REHAU's research and development team began working on lightweighting strategies for plastic extrusions used in aircraft interiors. Their research showed that solutions such as foaming were not viable, since the resulting parts failed to meet required stiffness and strength specifications. What REHAU needed was a density-reducing additive for its existing PPSU and PEI polymers – one that would allow a suitable balance of light weight and good mechanical properties. A particular 3M product line stood out as promising: 3M™ Glass Bubbles, performance-enhancing hollow glass microspheres used to reduce weight and improve processing in a variety of resin systems. When an injection molding grade, 3M™ Glass Bubbles iM30K, was introduced in 2007, both companies were intrigued by the possibilities. Scientists from REHAU soon embarked on a project to develop a low-density polymer system specifically for the aircraft industry, calling on 3M for its expertise and experience with incorporating glass bubbles into resin systems.

The goal for the new material was to reduce part weight by at least 10% without compromising system integrity. Both PPSU and PEI are relatively expensive but, by substituting a portion of the resin with high loadings of 3M glass bubbles, REHAU hoped to reduce overall material cost, along with density.

For two years, 3M worked with REHAU on the development of the new material. 3M glass bubbles iM30K, with an isostatic crush strength of 28,000 psi, were selected for their ability to survive the most demanding manufacturing processes, and to maintain properties such as surface hardness and dimensional stability in finished parts. For REHAU, these glass bubbles were surface-treated to strengthen the microsphere-to-polymer bond, solving an initial foaming problem.

#### A sustainable advantage

REHAU's new material, “RAU-FLIGHT,” made its debut at the 2010 “K Show” in Düsseldorf, Germany. RAU-FLIGHT is designed for extrusion profiling of a variety of interior aircraft cabin components. Without altering the thermoplastics' mechanical properties, the addition of 3M glass bubbles achieves considerable weight reduction: 10% in PEI and 12.6% in PPSU.

For the fiercely competitive airline industry, reducing weight to improve fuel economy is an effective means of offsetting sky-high oil prices. But the savings provided by glass bubble-filled RAU-FLIGHT transcend part weight; by enabling greater energy efficiency, this material also contributes to environmental sustainability.

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According to Bernd Kupferer, business unit manager for REHAU Industrial Solutions, RAU-FLIGHT could help aircraft operators attain significant fuel savings. “We have determined that a single handrail system for an Airbus A320, made with these new RAU-FLIGHT materials, would reduce weight by more than 5 kg per aircraft, resulting in a savings of about 1,000 liters of fuel per year,” states Kupferer. “If you extend this to a fleet of 150 aircraft, over a 15-year operating life the total fuel savings would be about 2.25 million liters of jet fuel. That not only saves money for the airline, but is also a significant reduction in carbon emissions.”

Having achieved such impressive weight savings in PPSU and PEI systems, REHAU is exploring the expansion of the RAU-FLIGHT product family by formulating 3M glass bubbles into other materials, such as polyamides, and by extending their use to injection-molded applications. Thanks to the technical collaboration between REHAU and 3M, the future of flight promises to be more fuel efficient – proving that, with teamwork and innovation, the sky’s the limit.

**United States**

3M Energy and Advanced Materials Division  
800 367 8905

**Brazil**

3M do Brasil Ltda.  
5519 3838 7000

**Canada**

3M Canada Company  
800 364 3577

**Europe**

3M Belgium N.V.  
32 3 250 7521

**India**

3M India Limited  
Bangalore  
9180 2231414

**China**

3M China Ltd.  
86 21 6275 3535

**China**

3M Hong Kong Limited  
852 2806 6111

**Taiwan**

3M Taiwan Limited  
886 2 2704 9011

**Korea**

3M Korea Limited  
82 2 3771 4114

**Japan**

Sumitomo 3M Limited  
813 3709 8250

**Philippines**

3M Philippines, Inc.  
63 2 813 3781

**Singapore**

3M Singapore Pte. Ltd.  
65 454 8611

**Malaysia**

3M Malaysia Sdn. Berhad  
60 3 706 2888

**New Zealand**

3M New Zealand Ltd.  
64-9-444-4760

**Australia**

3M Australia Pty., Ltd.  
61 2 9498 9333

**Other Areas**

651 736 7123 (U.S.)

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**Energy and Advanced Materials Division**

3M Center  
St. Paul, MN 55144-1000  
www.3M.com/engineeredadditives

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