

Developing materials to help reduce aircraft cabin noise is a balancing act



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There are two modes of noise typically found on aircraft: structure-borne and airborne. Structure-borne noise is made by the vibration of interior components, while airborne noise is from the sound of the engines or aerodynamic flow over the fuselage. "Good acoustic design mitigates both noise modes by using various design techniques that often require targeted materials. From an engineering perspective, a system design approach is necessary to accomplish this," says Adith Sujan, senior materials development engineer at Rogers Corporation.

In addition to reducing noise, the materials must meet the strict flammability, smoke, toxicity, weight and durability requirements demanded by the aircraft industry. Materials used to isolate the vibration of interior components or block outside noise must meet FAR25.853 and FAR25.856. While many materials meet the 12-second and 60-second vertical burn requirements of FAR25.853, there are fewer material choices for the radiant panel FAR25.856 test.

"The typical noise level in the economy section of a commercial aircraft is about 75dBA," says Sujan. "A variety of materials have been developed to meet the needs of this noise level on common commercial aircraft. The systems design approach, using isolation and barrier materials, typically improves noise levels to 65dBA or better."

Acoustic insulation is located between the aircraft skin and the interior side panels. For improved performance a noise-blocking (mass) layer such as a flame-retardant silicone rubber is used in a composite commonly referred to as an 'insulation blanket'. This material acts as a noise barrier by virtue of its mass, and must meet

FAR25.856. The composite structure often includes both a noise barrier and an absorbing material (fibre-glass batting or foam).

"Silicone materials and composites are often an excellent choice for aircraft applications because of their excellent flame, smoke and toxicity performance," says Sujan. "Also, silicone-based polymers maintain physical properties over a wide temperature range (temperature stability) and have great environmental resistance, specifically very low water absorption. Silicone properties have shown very little ageing effect, making them a reliable choice for installations that will be in place over an extended lifetime."

Sujan says that the systems design approach involves developing materials that balance flammability, acoustic performance, durability and weight. Formulating silicone rubbers for high-performance applications typically involves using customised fillers to provide properties such as improved flammability, reduced smoke or improved acoustic properties. "The challenge when developing a material to pass demanding flammability tests such as FAR25.856 is finding a balance between fire performance and mechanical properties," says Sujan.

Rogers Corporation recently launched the BISCO A2 solid silicone sound barrier for use on aircraft interior components to reduce cabin noise. This material has already gained approval at Airbus on the ABS5708 specification. Rogers Corporation says it is designed to offer excellent barrier performance while exceeding aircraft industry standards for flammability, smoke density and toxicity. The A2 material meets FAR25.856 (a), and is available in a variety of areal densities from 1.2-8.2kg/m².

Adith Sujan
+1 630 784 6211
adith.sujan@rogerscorporation.com
Reader Enquiry No. 505