NASA TECH BRIEF

Ames Research Center

Low-Density Polybenzimidazole Foams for Thermal Insulation and Fire Protection

The thermophysical properties of polybenzimidazole foams make them particularly useful as a material for construction of wall structures, especially interior walls in aircraft. However, as prepared by the usual processes, the foams are not of the desirable light weight, i.e., their density falls in the range of 400 to 800 kg/m^3. Carbon or silica microballoons have been incorporated in the foams during manufacture to reduce weight, but a density lower than 160 kg/m^3 has not been achieved.

A fire-resistant and nonsmoking foam can be prepared in the desirable density range of 24 to 50 kg/m^3 by controlled thermal crosslinking of polybenzimidazole prepolymer which has been prepared by the reaction of diphenyl isophthalate with 3,3′,4,4′-tetraaminobiphenyl monomer containing 95.0 to 97.6% theoretical orthodiamino groups. During the thermal crosslinking of the prepolymer, particularly in the temperature range of 457° to 550°K, volatile substances released during polymerization (phenol and water) cause foaming. Reproducible foams of a specific density can be produced by controlling the volatile content and the melting temperature of the prepolymer.

The polymer is heated to the maximum cure temperature of 740°-800°K in order to obtain the optimum thermophysical properties; the final product has good cell quality, resilience, and low friability. The foam may be reinforced by blending certain fibers with the prepolymer; the fiber additives increase the density of the foam, but may reduce the effective thermal conductivity by reducing the cell size.

Notes:

Requests for additional information may be directed to:

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Patent status:

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to:

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