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Brief 66-10111

NASA TECH BRIEF

Storage-Stable Foamable Polyurethane Is Activated by Heat

The problem:

To develop a polyurethane foamable mixture that will remain inert in storage until activated to produce a rapid foaming reaction. In the case of reactants normally used for commercial production of polyurethane foams, foam rise and cure usually occur within approximately two minutes after the reactants are mixed at room temperature. Several methods that have been tried to produce a storage-stable foamable mixture have included rapid chilling and low-temperature storage, the use of chemically blocked isocyanate derivatives that can be made reactive by heating, and the use of mixed solid reactants with melting points covering a range above room temperature.

The solution:

A storage-stable foamable composition that can be spread as a paste on the surfaces of an expandable structure and is capable of undergoing a rapid foaming reaction when heated to approximately 180°F. The reaction is completed within two minutes and yields a rigid open-cell polyurethane foam (density, 3 to 10 pounds per cubic foot) that is self-bondable to the substrate.

How it's done:

The foamable mixture consists of the following components in percentage by weight:

Hydroxyl-terminated prepolymer	55.4
4,4′-diphenyl methane diacyl azide	16.5
Bisphenol adduct of 4,4′ diphenyl methane diisocyanate	26.0
Alkyl silane-polyoxyalkylene copolymer (surfactant)	1.6
Dibutyltin dilaurate (catalyst)	0.5

This mixture is blended into a slurry with 30% to 40% by weight of acetone. Most of the acetone is then removed from the slurry by vacuum evaporation at or below 80°F to produce a spreadable paste for application to a substrate. After the paste is spread, additional acetone is evaporated until not more than 1% by weight is left in the spread, to avoid accelerated decomposition of the azide component in storage.

Notes:

1. Commonly used basic urethane polymerization catalysts, such as triethylene diamine, must be excluded from the composition to obtain a room-temperature storage life in excess of 30 days.
2. Suggested applications of this foamable composition include foldable emergency shelters and unsinkable liferafts. If suitable agents are added to the composition to make the foam fire-retardant, it may be used on folding fire doors and walls.
3. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Langley Research Center
   Langley Station
   Hampton, Virginia, 23365
   Reference: B66-10111

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C., 20546.

Source: Goodyear Aerospace Corporation
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Langley Research Center
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Category 03