

NASA TECH BRIEF

Lewis Research Center



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Thin KAPTON® Polyimide Films Vacuum Formed at High Temperature Retain Their Shape at Temperatures to 450 K (350°F)

During an investigation of thin plastic films for encasing self-evacuating multilayer insulation systems for spacecraft, it has been shown that KAPTON® polyimide films vacuum formed at 672 K (750°F) retain their shape after repeated exposure at temperatures up to 450 K (350°F).

Previously, KAPTON® film had been drawn by vacuum forming at 478 K (400°F) followed by a slow cooling at room temperature. However, the formed material relaxes and loses its set when reheated to 450 K (350°F). Recently, three-mil thick type H KAPTON® film has been successfully drawn to depths of about one inch by increasing the forming temperature to 672 K (750°F). The film is draped over a male mold and its edges clamped to the form. The form is evacuated and placed in an oven at 672 K (750°F) for one hour. It is then removed and quenched to ambient temperature by spraying with tap water.

Five kinds of commercially available thin plastic films were tested for suitability as insulation casing material. The casing encloses multiple layers of reflective thermal radiation material separated by spacer materials and is sealed at the edges to form a vacuum tight envelope. The sealed assembly is charged with a gas such as nitrogen which condenses at cryogenic temperatures to produce a vacuum within the casing. Fifteen kinds of commercially available adhesives were tested for suitability as casing edge bonding materials.

The purpose of the investigation was to identify candidate materials for self-evacuating multilayer insulation systems to be used on liquid hydrogen tanks on the space shuttle, which would survive re-entry temperatures and the mechanical and thermal cycling of one hundred flights.

Notes:

1. No further details are available on the KAPTON® forming process, however, the following report describes the entire investigation:

NASA CR-121166 (N73-30883), Reuseable Light Weight Modular Multi-Layer Insulation for Space Shuttle

Copies may be obtained at cost from:
Aerospace Research Applications Center
Indiana University
400 East Seventh Street
Bloomington, Indiana 47401
Telephone: 812-337-7833
Reference: B75-10016

2. Specific technical questions may be directed to:

Technology Utilization Officer
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Patent Status:

NASA has decided not to apply for a patent.

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