

NASA TECH BRIEF

Lewis Research Center



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Low-Void Polyimide Resins for Autoclave Processing

Continuing research on a series of thermally stable addition (A)-type polyimide polymers has produced a polyimide resin suitable for autoclave processing, which can be used to produce low-void composite materials.

Fiber reinforced plastic composite materials with high level mechanical properties and high temperature serviceability are destined for many aerospace and other industrial applications. The size and configuration of such proposed structures require that the composites be molded by an autoclave process.

In NASA Tech Brief 69-10118, a method was described for synthesizing thermally stable polyimide prepolymers which cured without the release of volatile material. Based on this work, an advanced A-type polyimide has recently been developed which can be used to produce autoclave molded, low-void content composites suitable for use at temperatures up to 316°C. Glass fiber and high modulus graphite fiber reinforced laminates (flat panels) have been successfully fabricated in an autoclave process.

The autoclavable A-type polyimide formulation, called P10P-A, consists of a mixture of Methyl Nadic Anhydride, an 80:20 molar ratio of methylene dianiline and thiodianiline, and pyromellitic dianhydride at a formulated molecular weight of 1000. Glass reinforced autoclave composites containing P10P-A have flexure strengths of over 5.5×10^8 N/m² (80,000 psi) at room temperature with 75% retention at 316°C. Interlaminar shear strength retention at 316°C is greater than 60% and modulus retention is greater than 85%.

To establish the utility of the new P10P-A formulation, a demonstration structural component consisting of T-sections and curved sections was autoclaved. The

demonstration component had a low void content and maintained mold dimensions within 0.2 mm.

Notes:

1. The low-void polyimide resin material and autoclaving process appear to have many useful applications. While aimed primarily at making autoclaving of A-type polyimide resins possible, the new P10P-A polyimide prepolymer can also be fabricated into reinforced and unreinforced structures by press molding or laminating techniques.
2. The following NASA Tech Briefs describe other Lewis Research Center-sponsored work on polyimide polymers:

Tech Brief 69-10118
 Tech Brief 70-10300
 Tech Brief 70-10330
 Tech Brief 70-10504
 Tech Brief 71-10442
 Tech Brief 72-10175

3. The following documentation may be obtained from:
 National Technical Information Service
 Springfield, Virginia 22151
 Single document price \$3.00
 (or microfiche \$0.95)

Reference: NASA CR-72984 (N72-18584),
 Thermally Stable Laminating Resins

4. Technical questions may be directed to:
 Technology Utilization Officer
 Lewis Research Center
 21000 Brookpark Road
 Cleveland, Ohio 44135
 Reference: B72-10728

(continued overleaf)

Patent status:

Inquiries concerning rights for the commercial use of
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