

NASA TECH BRIEF

Lewis Research Center



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New Polyimide Polymer Has Excellent Processing Characteristics with Improved Thermo-Oxidative and Hydrolytic Stabilities

New rapid-curing, stable polyimide polymers with high-temperature strength and thermal stability were previously described in NASA Tech Brief 69-10118. A modification of this basic formulation has resulted in a polyimide prepolymer P10P with improved thermo-oxidative stability in air at temperatures up to 340°C (650°F) and improved hydrolytic stability. Also, the processing characteristics of this new polymer are excellent. As a varnish, P10P can be used to impregnate fibers directly and thus be processed into advanced composites. P10P polyimide also shows promise for use as a molding powder and an adhesive; this material and its processing technique appear applicable to most high-temperature plastic products, devices and castings.

Processing studies of P10P showed that it possesses excellent flow characteristics and hence, offers promise in bag molding processing methodology. This high resin flow property is important to vacuum bag, autoclave, and pressure bag fabrication because it permits molding at low pressures, 34.5 to 138 x 10⁴N/m² (50-200 psi), and at relatively low heat-up rates of 1.7 to 8°C/min (3-15°F/min). The addition type cure of P10P eliminates the evolution of volatile matter during cure, which occurs with conventional condensation type polyimides, thereby ensuring production of low void composite structures.

The applications of fiber reinforced plastic structures range from nose cones and rocket engine nozzles to housing modules. Fibers such as glass, graphite, boron, etc., are impregnated with resin varnishes to produce composite structures; and P10P polyimide can produce thermoset reinforced plastic composites with nearly all these types of fibers. As demonstrated, the processing of P10P provides adequate flow properties for a wide

range of prepreg (up to one-half-inch thick) lay-ups, yielding a composite with low void content and, therefore, good structural integrity.

Notes:

1. NASA Tech Brief 69-10118 describes this new class of polyimide polymers, their properties and some applications. Other applications of these polymers are also described in Tech Briefs 70-10300 and 70-10330.
2. 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-72633 (N71-11657),
Thermally Stable Laminating Resins

3. Technical questions may be directed to:
Technology Utilization Officer
Lewis Research Center
21000 Brookpark Road
Cleveland, Ohio 44135
Reference: B72-10175

Patent status:

No patent action is contemplated by NASA.

Source: R. J. Jones, R. W. Vaughan, and
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