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Materials and Coatings

Processable Polyimides Containing APB and Reactive End Caps

Polyimides with properties that can be tailored through proportions of dianhydrides and APB

Polyimides are the most popular high performance polymer because they provide a unique combination of mechanical, thermal, and chemical properties. Homopolymers that contain only other diamines and dianhydrides and that are not processable under conditions reported previously are made processable by this invention by incorporating various amounts of APB. Such polyimides can also be tailored for different applications.

BENEFITS

- ➔ Processable at low pressures [200 psi (1.38 MPa)], when the appropriate amounts of APB are utilized
- ➔ High degrees of resistance to solvents
- ➔ High glass-transition temperatures
- ➔ High moduli of elasticity

APPLICATIONS

- ➔ Coatings
- ➔ Prepreg resins
- ➔ Films
- ➔ Fibers
- ➔ Moldings

technology solution



NASA Technology Transfer Program

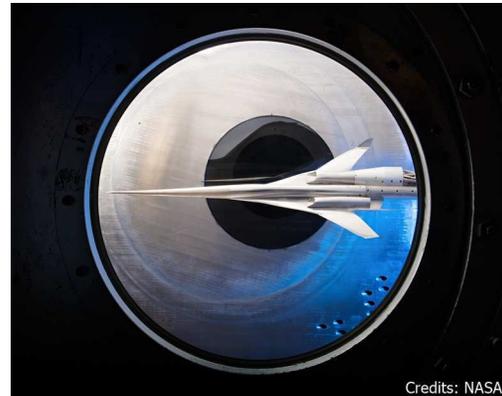
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THE TECHNOLOGY

Imide copolymers that contain 1,3-bis (3- aminophenoxy) benzene (APB) and other diamines and dianhydrides and that are terminated with appropriate amounts of reactive end caps have been invented. The reactive end caps investigated thus far include 4- phenylethynyl phthalic anhydride (PEPA), 3-amino- phenoxy-4'- phenylethynyl benzophenone (3-APEB), maleic anhydride (MA), and 5-norbornene-2,3-dicarboxylic anhydride [also known as nadic anhydride (NA)]. The advantage of these copolyimides terminated with reactive groups, relative to other polyimides terminated with reactive groups, is a combination of (1) higher values of desired mechanical-property parameters and (2) greater ease of processing into useful parts.

Homopolymers that contain only other diamines and dianhydrides and that are not processable under conditions reported previously can be made processable by incorporating various amounts of APB according to this invention, depending on the chemical structures of the diamines and dianhydrides used. These copolyimides exhibit high degrees of resistance to solvents, high glass-transition temperatures, and high moduli of elasticity, but are processable at low pressures [200 psi (1.38 MPa)], when the appropriate amounts of APB are utilized. In addition, when these copolymers are terminated with phenylethynyl groups, they exhibit long-term melt stability (several hours at temperatures approaching 300 C).

Thus, by choosing the ratio between the amount of APB and the amount of the other diamine in the polyimide backbone, one can obtain a material that has a unique combination of solubility, glass-transition temperature, melting temperature, melt viscosity, toughness, and high-temperature mechanical properties.



Concept aircraft

PUBLICATIONS

Patent No: 6,288,209; 6,133,401

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