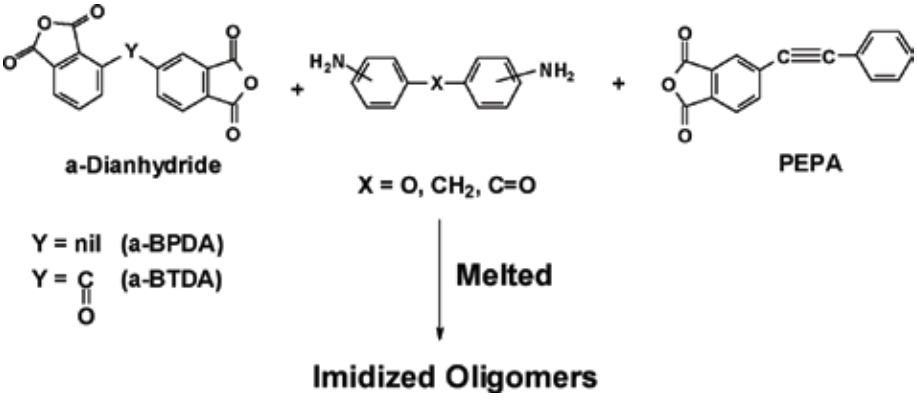
National Aeronautics and Space Administration

technology opportunity

High-Temperature, Low-Melt Viscosity Imide Resins for Liquid Molding

Fabricating RTM composites for aerospace components



NASA's Glenn Research Center invites companies to license or establish partnerships to develop high-temperature, low-melt viscosity imide resins for composite fabrication into aerospace components. Produced by a solvent-free melt process, these resins exhibit high glass transition temperatures (Tg's = 370-400°C), low-melt viscosities (10-30 poise), long pot-life (1-2 hours) and are amenable to resin transfer molding (RTM) and vacuum-assisted resin transfer molding (VARTM). These RTM resins melt at 260-280°C and can be cured at 340-370°C in 2 hours, without releasing any volatiles.

Benefits

- **High-temperature capability:** Performs above 300°C, exceeding conventional RTM resins such as epoxy and bismaleimides, which have use temperatures around 177°C and 232°C, respectively, for aerospace applications
- **Cost-effective:** Offers a 30 percent savings by fabricating complex parts more economically via the use of preforms in lieu of costly hand lay-up and to reduce scrap rate
- **Improved safety:** Eliminates the need for hazardous organic solvents

Applications

- Aircraft propulsion
- Airframe vanes, ducts, and bushings
- Missiles
- Rockets
- Radomes

Out-of-Autoclave Fabrication Methods:

- RTM and VARTM
- Powder Prepregs

Technology Details

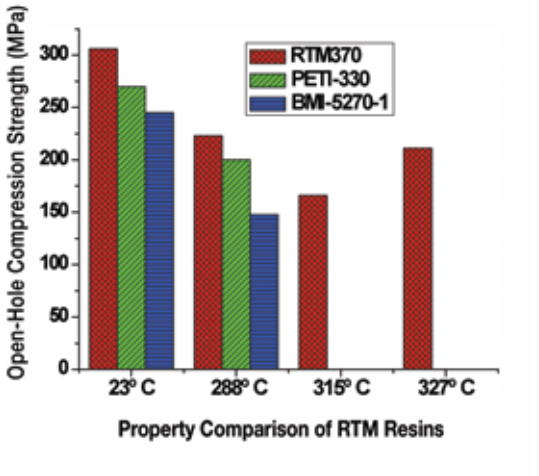
This technology was developed to make polyimide resins from novel asymmetric dianhydrides (a-dianhydrides) and kinked diamines to achieve low-melt viscosities that are amenable to low-cost RTM and VARTM, while retaining high-temperature performance above 300°C. These a-dianhydride-based RTM imide resins display low-melt viscosities (10-30 poise), which cannot be achieved using normal symmetric dianhydrides.

How It Works

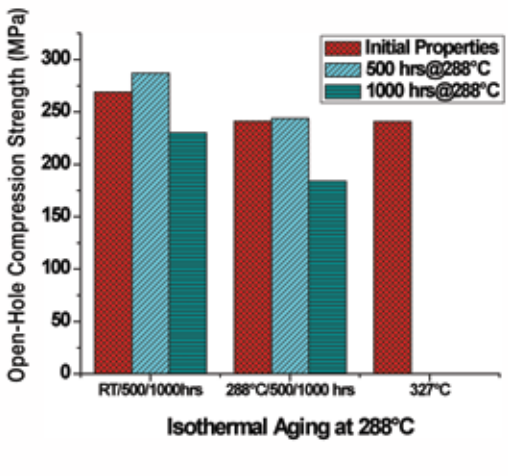
RTM imide resins can be melted at 260-280°C, and injected into fiber preforms under pressure (200 psi) or vacuum (VARTM). The resins also can be made into powder prepregs with unlimited out-time by melting the resin powders so that they fuse onto fibers.

Why It Is Better

RTM imide resins display high softening temperatures (370-400°C) and excellent toughness, as evidenced by the RTM370 resin's open-hole compression strength. The resins also possess outstanding thermo-oxidative stability by long-term isothermal aging at 288°C (550°F) for 1,000 hours (see the Figures below).



Property Comparison of RTM Resins



Isothermal Aging at 288°C

Patents

Glenn has secured patent protection for its Solvent-Free Low-Melt Viscosity Imide Resin technology: U.S. Patent No. 7,015,304.

Licensing and Partnering Opportunities

Glenn's Technology Transfer and Partnership Office seeks to transfer technology into and out of NASA to benefit the space program and U.S. industry. NASA invites companies to consider licensing or partnership opportunities for the High Temperature RTM Imide Resins for lightweight composite fabrication in aerospace applications (LEW-17618-1) technology.

For More Information

For more information about this and other technology licensing opportunities, please visit:

Technology Transfer and Partnership Office
NASA's Glenn Research Center
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Phone: 216–433–3484
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