

## 4000T, 4000TF

The well-known properties of Torlon polyamide-imide, from its unstoppable performance under extreme conditions to excellent resistance against wear, creep and chemicals can now be incorporated into your own compounds and specialty applications, with the use of these Torlon polyamide-imide powders. Torlon 4000T and 4000TF are both neat resin polyamide-imide (PAI) powders. Torlon 4000T is a coarse powder amenable to compounding with other polymers and specialty additives. It is the base resin utilized in all Torlon injection molded compounds. Torlon 4000TF is a fine-particle powder version, particularly suited for compression molded parts.

Depending on the application and performance criteria, Torlon 4000T or 4000TF PAI may be compounded or blended with other high performance polymers to enhance properties of the finished compound. In particular, Torlon 4000T has been shown to be useful in blends with polyphenylsulfone (PPSU), polyethersulfone (PES), polysulfone (PSU), polyetheretherketone (PEEK), high-temperature sulfone resins, self-reinforced polyphenylene, polybenzimidazole (PBI), polyimide (PI), polyetherimide (PEI), and polyphenylene sulfide (PPS). Besides blending with other polymers to enhance properties, Torlon 4000T powder may be compounded with a wide variety of performance fillers, reinforcements, specialty additives and colorants to meet the desired need. The resultant compound may then be injection molded or extruded into film, shapes or fiber.

The strength and wear properties of compression molded compounds can be uniquely improved through addition of Torlon 4000TF powder. Polytetrafluoroethylene (PTFE) and related fluoropolymer compounds show higher strength, greatly reduced creep behavior and better performance in wear-resistant applications, when Torlon 4000TF is added. Torlon 4000TF serves as a high temperature, high performance matrix binder for other diverse compression molded parts such as clutches, brake pads, and their components, fused metal powders, and thermoplastic magnets. The fine powder also may be used in thermal spray processes such as flame spray and high-velocity oxyfuel (HVOF) spray techniques.

Besides molded components, Torlon PAI powders are quite amenable for use in other high performance forms. For example, these powders are soluble in dipolar aprotic solvents such as N-methyl pyrrolidone (NMP), dimethylacetamide (DMAC), dimethylsulfoxide (DMSO)

and dimethylformamide (DMF). The solutions of such systems can then be sprayed into coatings, cast into films, spun into fibers and cast or spun into specialty membranes. High strength, high temperature capable adhesives can be also formulated from Torlon PAI powders. Torlon PAI powders may be incorporated into epoxy and other thermoset systems to provide additional strength, ductility and heat resistance.

Torlon 4000T powders are available in 3 viscosity grades; Torlon 4000T-LV (low viscosity), 4000T-MV (medium viscosity) and 4000T-HV (high viscosity). These are defined by the inherent viscosity (IV) ranges as indicated in the table below.

Torlon 4000TF is a fine particle size version of 4000T. It has a maximum particle size of 150 µm with 95% less than 75 µm. The majority of material is the range of 30-40 µm. The IV for this grade is greater than 0.50, the typical range is 0.50-0.65.

Material	IV (0.5% in NMP at 25°C, 77°F)
Torlon 4000T-LV	0.50-0.59
Torlon 4000T-MV	0.60-0.69
Torlon 4000T-HV	0.70-0.90
Torlon 4000TF	>= 0.50

### Properties

The bulk material properties of Torlon 4000T resin may be approximated by comparison to the properties of injection molded and cured Torlon 4203L parts from the Torlon PAI Design manual. Material forms other than injection molded and cured Torlon 4000T, may have considerably different and typically lower properties than those listed for 4203L.

## Compounding and Extrusion

Technical advice for compounding of Torlon powders may be obtained from your Solvay representative.

## Compression Molding

Torlon 4000TF powder is pre-heated in an oven, from 1 to 24 hours at 500-600°F (260-316°C), prior to compression molding. The purpose is to increase molecular weight and complete the imidization processes, both of which create water and can lead to voids in the compression molded article. The compression molding schedule depends on the size and geometry of the mold. Please contact your Solvay representative for further technical information.

## Drying

Drying Torlon resin to a moisture content of 500 ppm or lower is required to avoid molding problems, like brittle parts and foaming. The resin should be dried in a circulating air oven equipped with a desiccant system. Place the resin in layers no more than 2 to 3 inches (5 to 8 cm) deep in drying trays. Minimum drying times are: 3 hours at 350°F (177°C), 4 hours at 300°F (149°C), or 16 hours at 250°F (121°C).

## Post-Cure

Parts and components containing Torlon powders should be properly cured to reach maximum properties and performance characteristics. Molded parts are thermally cured over a time period depending on the part size and geometry. Further information on cure schedules is available in the Torlon PAI Molding Guide. Coatings, films, adhesives and other forms must also be thermally treated as well, to remove residual solvents and cure the Torlon polymer. Technical advice on a proper cure schedule may be obtained from your Solvay representative.

## Standard Packaging and Labeling

Torlon 4000T and 4000TF resins are packaged in lined cardboard boxes containing 25 kg (55.115 pounds) of material. Special packaging can be supplied upon request. Individual packages will be plainly marked with the product number, the color, the lot number, and the net weight.

## Product Safety and Emergency Service

For product safety information or a Material Safety Data Sheet on a product of Solvay Advanced Polymers

**1 (800) 621-4557**  
**1 (770) 772-8880 outside of U.S.**

For information or help in an emergency such as a spill, leak, fire or explosion, call day or night:

Emergency Health Information

**1 (800) 621-4590**  
**1 (770) 772-5177 outside of U.S.**

Emergency Spill Information

**CHEMTREC 1 (800) 424-9300**  
**1 (703) 527-3887 outside of U.S.**  
**collect calls accepted**

## For Additional Information

Technical Service  
**1 (800) 621-4557**

Customer Service  
**1 (800) 848-9744**

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