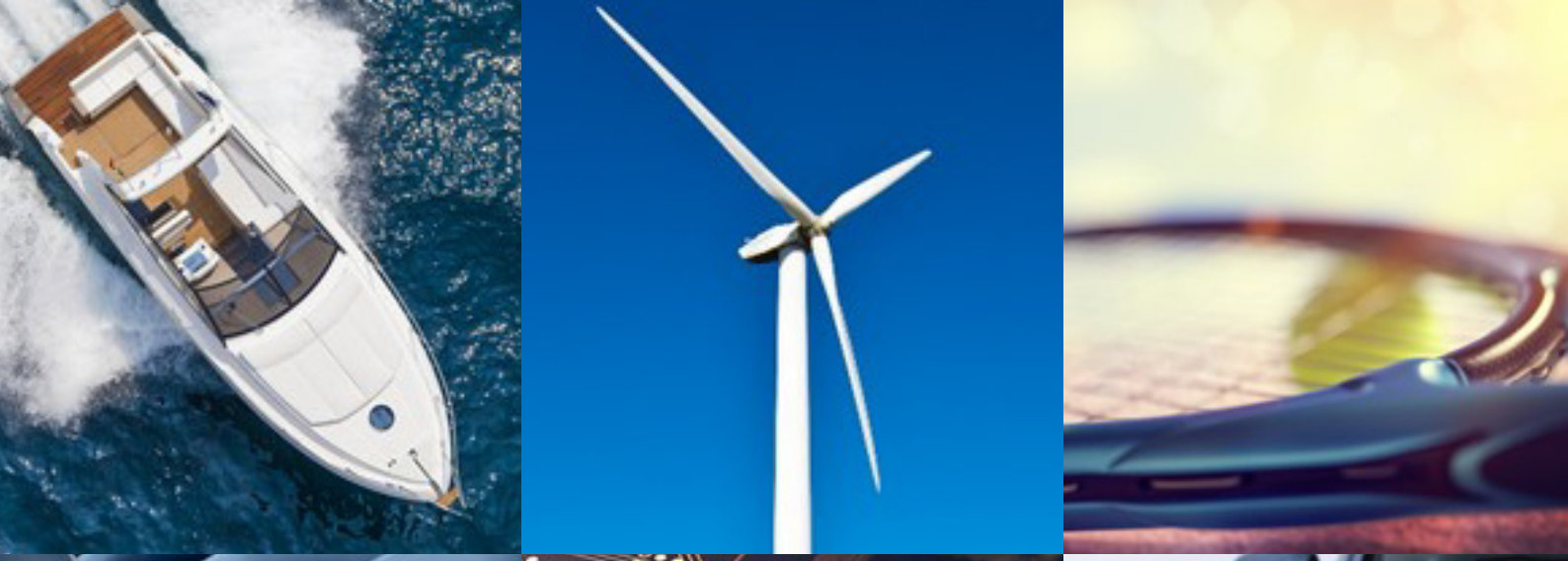


PARALOID™ TMS-2670J Impact Modifier

Enabling improved performance of Epoxy resins

Over the last few decades, Epoxy resins have found use in several industrial and consumer applications. Their versatility in combining chemical and temperature resistance, as well as excellent adhesion and electrical insulation properties, allows a wide variety of uses in structural adhesive, composite, coating, and casting applications for adhesives, windmills, automotive, aerospace, or electric and electronics.

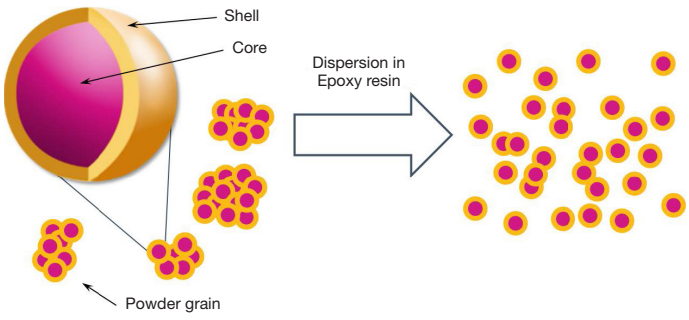
However, the brittle mechanical nature of Epoxy resins can limit their usage in demanding applications with challenging technical requirements.

The incorporation of a dispersed rubber phase is an effective method of improving fracture resistance and impact strength of brittle polymers.

PARALOID™ TMS-2670J Impact Modifier, is a new impact modifier specially designed by Dow for Epoxy resins. It is readily dispersible and contributes to efficient impact modification.

The toughness of Epoxy resins can be measurably improved using PARALOID™ TMS-2670J Impact Modifier.

PARALOID™ TMS-2670J dispersion process in Epoxy



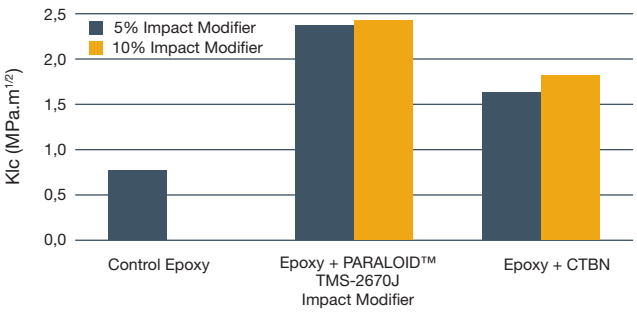
Peace of mind in performance

Performance and reliability

The performance and reliability of the compounded Epoxy resin can be greatly improved by adding PARALOID™ TMS-2670J Impact Modifier, even at low dosage: fracture toughness can be increased three fold compared to the neat Epoxy resin.

Fracture toughness

According to ASTM D5045



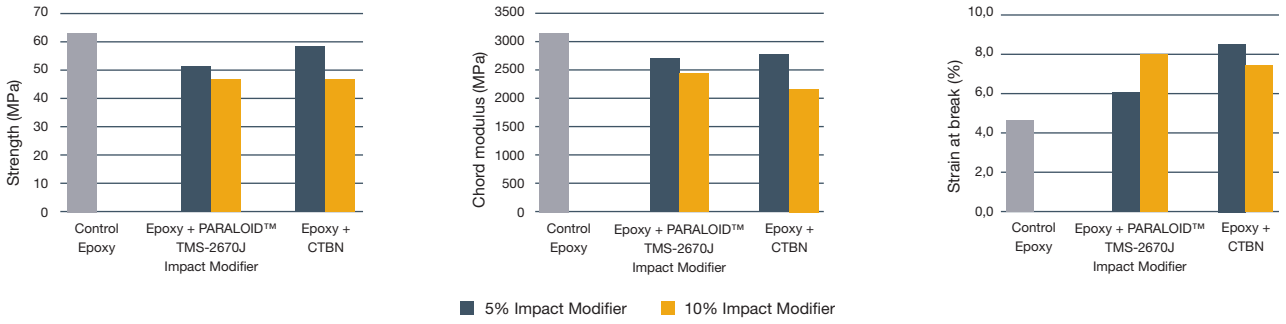
Contribution towards sustainability goals

PARALOID™ TMS-2670J Impact Modifier, affords lifetime increases together with reduced maintenance.

In many end use applications, parts can undergo severe stress during a lifetime of extreme weather conditions. PARALOID™ TMS-2670J Impact Modifier enhances impact resistance and elongation, and contributes to good fatigue resistance.

Tensile properties

According to ISO 527-1 and 527-2

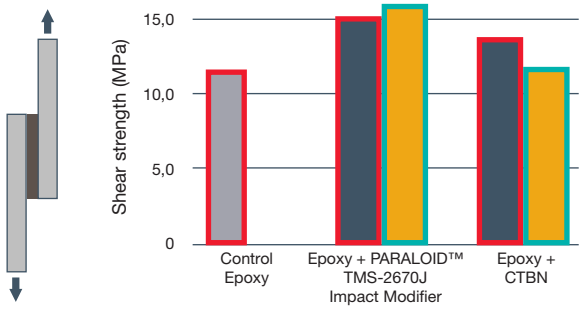


PARALOID™ TMS-2670J Impact Modifier, contributes to the creation of reliable lightweight end use products while reducing the number of component materials.

PARALOID™ TMS-2670J Impact Modifier facilitates excellent adhesion of substrates like metals, enabling a reduction in weight and time taken to bond components.

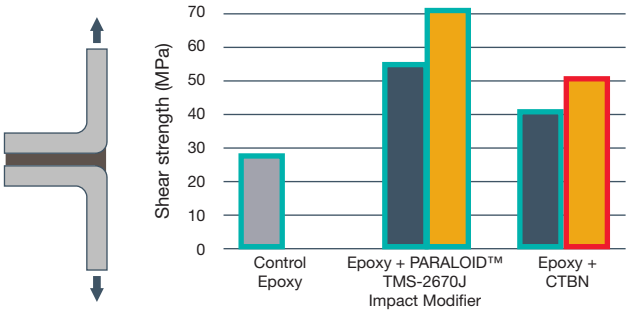
Single lap shear resistance on aluminum substrate

According to ASTM D1002



T-Peel resistance on aluminum substrate

According to ASTM D1876



Legend for both charts:

5% Impact Modifier 10% Impact Modifier

Reduced material waste is achievable, thanks to a lower number of breakages during preparation for component assembly, when PARALOID™ TMS-2670J Impact Modifier is added to Epoxy resin formulations.

In electronics applications, especially when Epoxy laminates are used, a high Glass Transition Temperature (Tg) is required to withstand high solder and operating temperatures. The addition of PARALOID™ TMS-2670J Impact Modifier to an Epoxy resin improves toughness without any impact on the final Tg of the resin. This can result in reduced breakages during hole drilling, and therefore contributes to cost optimization of the final product.

Wider range of high performance applications

In markets such as aerospace and sporting goods, a very high level of performance is often required. The extreme strength and stiffness required of the compounded Epoxy resin can be better attained by addition of PARALOID™ TMS-2670J.

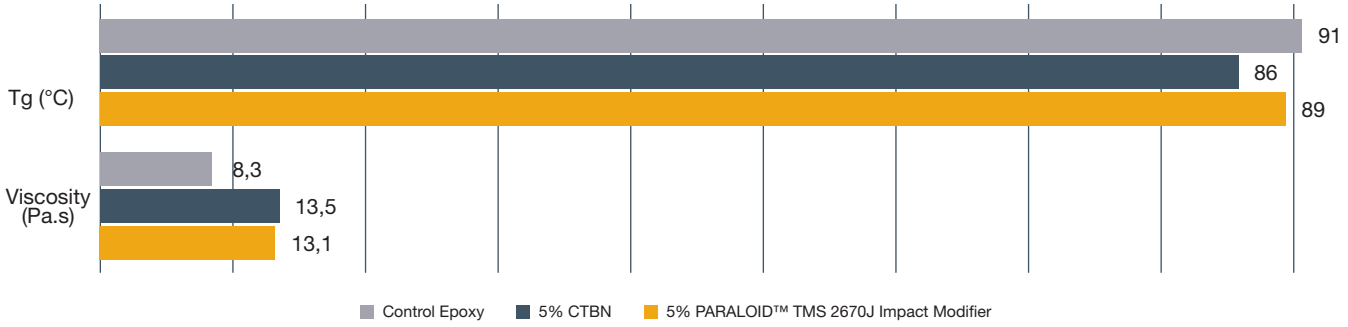
Cost efficiency in handling and processing

PARALOID™ TMS-2670J Impact Modifier leads to enhanced energy savings and increased productivity

The time and temperature needed to disperse the impact modifier in the liquid resin, are two key parameters determining production cost and equipment utilization.

As a result of it's limited influence on both the viscosity (due to good dispersibility) and the glass transition temperature of the Epoxy formulation, PARALOID™ TMS-2670J Impact Modifier contributes to efficient mixing, and curing, leading to an optimized processability of the impact modified Epoxy resin.

Influence of Impact Modifiers on viscosity and glass transition temperature



PARALOID™ TMS-2670J Impact Modifier is supplied in powder form which facilitates handling and dosing at the production site.

PARALOID™ TMS-2670J Impact Modifier provides an optimal balance of performance in end use Epoxy applications

About Dow

Dow (NYSE: DOW) combines one of the broadest technology sets in the industry with asset integration, focused innovation and global scale to achieve profitable growth and become the most innovative, customer centric, inclusive and sustainable materials science company. Dow's portfolio of performance materials, industrial intermediates and plastics businesses delivers a broad range of differentiated science-based products and solutions for our customers in high-growth segments, such as packaging, infrastructure and consumer care. Dow operates 113 manufacturing sites in 31 countries and employs approximately 37,000 people. Dow delivered pro forma sales of approximately $50 billion in 2018. References to Dow or the Company mean Dow Inc. and its subsidiaries. For more information, please visit www.dow.com or follow @DowNewsroom on Twitter.

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