

TECHNICAL BULLETIN

INHANCE™ PARTICLES STRENGTHEN ADHESIVES

Perhaps the most critical characteristic for an adhesive in its end use is the strength of the bond it forms. In practice, many factors can effect adhesive joint strength, including the internal strength of the adhesive, the ability of the adhesive to wet the substrate, the bond thickness, and the adhesive bonding area. The internal strength of the adhesive is often related to its modulus, which is a measure of the stiffness of the material. As a rule of thumb, both very high and very low modulus materials are undesirable as adhesives. A material with high modulus will tend to be brittle, causing the material to crack under stress. A low modulus material is often weak and tears easily.

In theory, thermoplastics can be used as a modulus modifier in adhesives. Thermoplastics that are tough and flexible resist both cracking and tearing. Because of these desirable properties, some thermoplastics can be used to modify epoxies and other adhesives with unacceptable moduli. Unfortunately, most thermoplastics with these properties are nonpolar, which makes them incompatible with epoxies and other structural adhesives because these adhesives are polar in nature.

Now INHANCE™ polyethylene particles make it possible to enhance adhesive properties through modulus modification. These particles, having polar surfaces, are readily incorporated into structural adhesive formulations. Inhance™ particles make it possible to combine the elasticity and toughness of polyethylene with the desirable properties of polar structural adhesives. INHANCE™ polyethylene particles can be used as a “modulus modifier” that either reduces the modulus of a brittle adhesive or increases the modulus of a weak adhesive. Thus, INHANCE™ particles can improve the strength and flexibility of structural adhesives.

Data illustrating how incorporation of INHANCE™ polyethylene particles in an epoxy increase performance as an adhesive is summarized below. In this experiment, the shear overlap strength of three adhesives bonding two pieces of steel were measured. The adhesive formulations were an unfilled epoxy, and two formulations incorporating 10% and 30% by weight INHANCE™ UH-1250, surface-modified UHMWPE particles. **The sample made with 30% INHANCE™ particles shows a lap shear increase of almost 50%.**

Adhesive ¹	Lap Shear Strength ² (psi)
Unfilled epoxy	7,500
10% (wt) INHANCE™ UH-1250	9,200
30% (wt) INHANCE™ UH-1250	11,100

¹ Cold Cure Epoxy from Industrial Formulators, Ltd. (Bisphenol A / dibutyl phthalate / alkylamine)

² ASTM D 1002 procedure