CAB-O-SIL® ULTRABOND™
FUMED SILICA FOR EPOXY ADHESIVES
Introduction

We have a long history of supporting adhesive and sealant manufacturers to meet new performance requirements. Fumed silica provides rheology and reinforcement to adhesive and sealant formulations. Our CAB-O-SIL® fumed silica products meet and exceed the challenging requirements of our global customers. CAB-O-SIL ULTRABOND™ fumed silica sets a new standard of performance for epoxy adhesives when it entered the market.

CAB-O-SIL ULTRABOND fumed silica is our highest performing surface treated fumed silica. Compared to other polydimethylsiloxane (PDMS) treated silicas, CAB-O-SIL ULTRABOND fumed silica improves adhesives systems by reducing the viscosity in the application without compromising sag resistance.

CAB-O-SIL ULTRABOND fumed silica is best suited for epoxy adhesives with loading levels greater than 5% and those that require high sag resistance and excellent storage stability.

Structural adhesives

CAB-O-SIL ULTRABOND fumed silica improves adhesive performance in epoxy formulations for use in a wide range of industries including automotive, aerospace, construction, electronics and flooring.

The transportation industry now requires structural adhesives that can replace traditional welding or riveting to bond two vehicle parts together. The use of structural adhesives in transportation manufacturing has steadily increased over the years, as it offers advantages over classic bonding techniques, including the ability to use lightweight design components with improved mechanical strength. These lightweight components help the transportation industry achieve more aggressive weight-reduction goals and improve vehicle fuel efficiency.

Sag resistance and storage stability

In epoxy resins, CAB-O-SIL ULTRABOND fumed silica provides excellent sag resistance and storage stability compared to other PDMS treated silicas. Figure 1 shows the sag resistance in epoxy resin, as assessed by a yield stress measurement, upon manufacture and after 28 days of accelerated aging at 60 °C. The epoxy resins containing CAB-O-SIL ULTRABOND fumed silica were shown to provide higher yield stress both initially and after aging than epoxies made with competitive PDMS-treated silicas.
Wind bonding paste, used to manufacture wind blades, is a critical component with strict performance requirements. As a result of collaboration between our adhesives applications development team and wind blade producers, CAB-O-SIL ULTRABOND fumed silica enables significant improvements in sag resistance and storage stability of bonding paste. This enables bonding paste to have an extended shelf life, allowing producers to ship paste to blade manufacturers around the world. CAB-O-SIL ULTRABOND fumed silica can be added to bonding paste at lower loadings, while still maintaining sag resistance and reduced viscosity.

**Delivers better performance at lower loading**

As shown in Figure 2, instead of the typical fumed silica loading of 8% in epoxy based bonding paste, CAB-O-SIL ULTRABOND fumed silica loading could be reduced by 10 – 15% versus competitive products, while still maintaining the same sag resistance performance. This can effectively reduce the processing time, allowing bonding paste producers to decrease their respective manufacturing costs while increasing their manufacturing capacity.

To generate the data shown in Figure 3, equal amounts of silica were incorporated into an epoxy resin. The relative amount of time to incorporate the competitive silicas was 1.5 times that of ULTRABOND fumed silica. In formulations with high silica loadings, the faster incorporation of ULTRABOND fumed silica can translate into shorter batch times and higher throughput.
Shear thinning and recovery rate

The thixotropic (shear thinning) behavior imparted by PDMS-treated silica in an epoxy system is important to the adhesive formulator and user. At high shear rates equivalent to those imparted during mixing or bead application, the viscosity decreases, facilitating processing, pumping and dispensing of the adhesive. This is illustrated in Figures 4 and 5.

Following high shear mixing, viscosity recovers quickly to comparable levels exhibited by the formulation prior to high shear. During use, this can prevent an adhesive bead from slumping or sagging and fillers from settling.

CAB-O-SIL ULTRABOND fumed silica imparts higher viscosity than CAB-O-SIL TS-720 fumed silica, our other leading PDMS-treated silica, yet is equally shear thinning and provides a faster rate of viscosity recovery.

Figure 4: Shear thinning behavior of epoxy resin and polyamide curing agent at 5.4% silica loading

Figure 5: Shear thinning behavior of epoxy resin and polyetheramine curing agent at 6.2% silica loading