CABOT

FUMED METAL OXIDES

APPLICATION GUIDE

CAB-O-SIL® FUMED SILICA IN EPOXY COATINGS

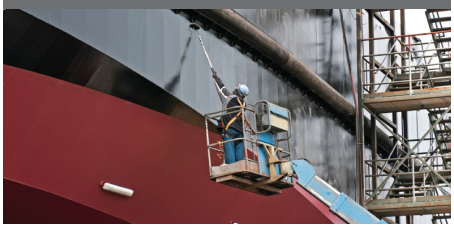
Application Description

Formulating an epoxy-based coating that delivers protection from corrosion and mechanical stress requires a complex combination of resins, additives, solvents, and pigments. Formulators are forced to make tradeoffs among rheological performance, adhesion, corrosion resistance, aesthetic properties, and cost of the final formulation.

CAB-O-SIL fumed silica can help to break these trade-offs by providing sag resistance, anti-settling, anti-corrosive performance, shelf stability and mechanical reinforcement in epoxy coatings.

Epoxy Coatings that Can Use CAB-O-SIL Fumed Silica Include:

MARINE PRIMERS



LIGHT INDUSTRIAL COATINGS

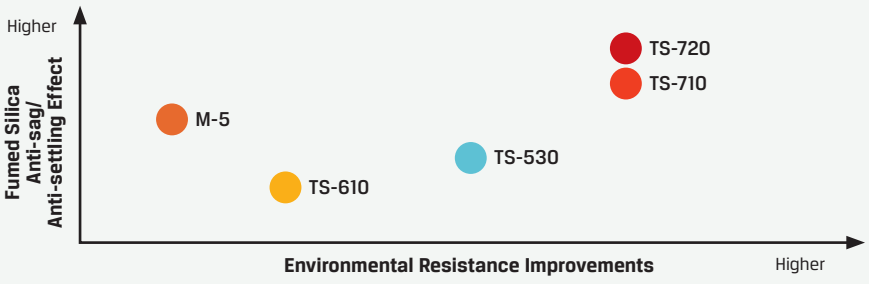
HEAVY MAINTENANCE COATINGS

CABOT PRODUCT OFFERING

Material Category	CAB-O-SIL Fumed Silica Products	Typical Surface Area m^2/gram	Treatment Agent	Product Characteristics
Hydrophobic Fumed Silica	TS-720	120	PDMS	CAB-O-SIL TS-720 and TS-710 fumed silicas should be considered for use in highly polar resin systems. TS-710 fumed silica is somewhat easier to disperse than TS-720 fumed silica, but delivers lower thickening efficiency.
	TS-710	100		
	TS-610	125	DiMeDi	CAB-O-SIL TS-610 fumed silica should be considered for use in both polar and non-polar resin systems, especially when ease of dispersion is a primary formulation consideration.
	TS-530	225	HMDZ	CAB-O-SIL TS-530 fumed silica should be considered for use as a rheology control additive in moderately polar resin systems.
Hydrophilic Fumed Silica	M-5	200	N/A	CAB-O-SIL M-5 fumed silica should be considered for use as a rheology control additive in all resin systems, when hydrophobicity and shelf stability are of only moderate concern. Other hydrophilic grades may also be used.

Surface area measured by BET of product as sold. The data in the table above are typical test values intended as guidance only, and are not product specifications. Product specifications are available from your Cabot representative.

PRODUCT PERFORMANCE



In epoxy coatings, achieving excellent sag resistance and anti-settling performance from a rheology control additive is desired. CAB-O-SIL fumed silica also improves resistance to environmental factors, especially water, humidity, and corrosion resistance. CAB-O-SIL fumed silica further provides mechanical reinforcement and can improve film toughness.

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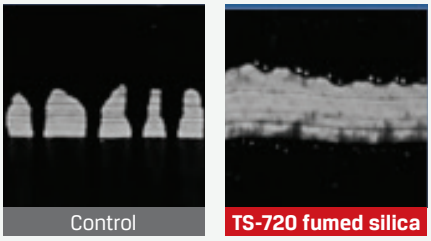
PRODUCT PERFORMANCE

Rheology Control

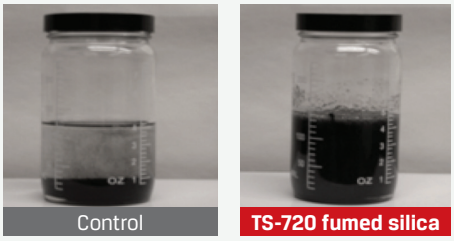
CAB-O-SIL TS-720 fumed silica delivers an ideal rheological profile. At low shear, the model epoxy formulation exhibits high viscosity, which prevents pigment settling and promotes excellent sag resistance. Under high shear conditions, such as mixing, spraying, or rolling, model formulations incorporating **CAB-O-SIL TS-720** fumed silica exhibit low viscosity, facilitating application of the coating.

Sag Resistance



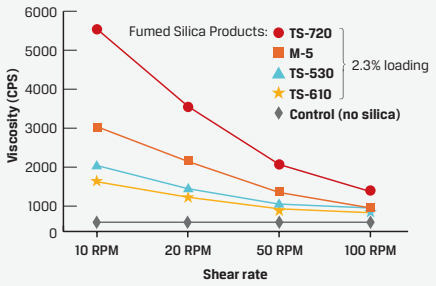
CAB-O-SIL TS-720 fumed silica allows the liquid coating to retain its vertical edge

Anti-Settling



CAB-O-SIL TS-720 fumed silica retards pigments from settling when at rest

Shear Thinning Effect

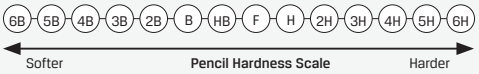


The product performance results above were obtained using the model formulation that follows. Only the fumed silica was changed.

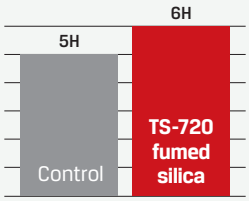
Enhanced Protection

The addition of a hydrophobic silica particle improves the mechanical strength of the coating and enhances the coating's ability to repel water.

Adding **CAB-O-SIL TS-720** fumed silica increases hardness to the point where the coating withstands a 6H pencil versus a 5H pencil for the neat epoxy control. This increase in hardness can be attributed to the presence of silica particles on the surface of the cured coating and the network that they form within it.



Pencil Hardness



Incorporating **CAB-O-SIL TS-720** into a 1.5 mil dry film coating inhibits blistering after 400 hours of salt spray corrosion testing. The hydrophobicity of **CAB-O-SIL TS-720** fumed silica inhibits water from penetrating the coating and reacting with the substrate.

Reduced Blistering

MODEL FORMULATION

The epoxy formulation below represents a typical simple black pigmented epoxy industrial coating.

Formulation

Part A		
Product Name	**Description**	**Amount (%)**
Epon 828	Epoxy resin	50.97
Propylene Glycol Ether	Co-solvent	20.66
BYK® 348	Wetting agent	0.58
Surfynol® 104DPM	Wetting agent	1.35
Dipropylene Glycol Normal Butyl Ether	Co-solvent	8.34
REGAL® R400R	Black pigment	1.16
CAB-O-SIL	Fumed Silica	2.23
Epon 828	Epoxy resin	14.71
Total %		**100.00**

Part B		
Epikure® 3292-FX-60	Curing agent	39.15
Part A	Dispersion	60.85
Total %		**100.00**

Formulation Processing

1. **Premix**
   a. Premix the Epon 828 epoxy resin (50.97%), Propylene Glycol Ether, BYK 348 wetting agent, Surfynol 104DPM wetting agent, and Dipropylene Glycol Normal Butyl Ether together under good agitation, mix for 5 minutes.
   b. Add REGAL 400R carbon black followed by CAB-O-SIL fumed silica under good agitation, mix for 5 minutes at 4000RPM.
2. **Milling**
   a. Mill the above in a horizontal mill for 5 minutes at 10 m/s tip speed.
   b. After 5 minutes milling, add the rest of Epon 828 epoxy resin (14.71%) into the mill then collect the dispersion (part A).
   c. Measure viscosity and solids content.
3. **Finish**
   a Premix part A and Epikure 3292-FX-60 curing agent under agitation for 15 minutes.
   b. Discharge the premix, wait 15 minutes for the foam to break then apply.

Recommended Equipment

Premix
- Dispermat high speed mixer
- Maximum speed: 4000 RPM
- Blade: 3 cm Cowles-type

Milling
- Eiger Horizontal mill
- Maximum speed: 10 m/s tip speed
- Media: 1.0 mm Yttrium Stabilized Zirconia (YTZ)

CABOT

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Technical Support
North America: 1 800 462 2313
South America: +55 11 2144 6400
Europe: +31 71 888 4132
Asia Pacific: +86 21 5175 8800