PRODUCT BULLETIN 14

Fillers

Talc

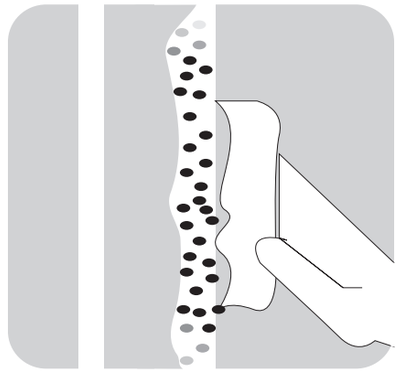
Cab-O-Sil

Visco-Fill II

Microspheres

Milled Glass Fibers

Chopped Fiber Glass



Add to polyester or epoxy resins to:

- make resin easy to sand
- strengthen bond properties
- thicken resin to patch/fillet
- reduce cost of resin mixture
- improve abrasion resistance
- reduce weight, shrinkage, or exothermic heat

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Tips

Some fillers can be difficult to mix by hand, due to their extremely fine particle size. Use a Squirrel Mixer (available in a TAP store) for mixing fillers thoroughly into resin. However, when mixing Microspheres with a Squirrel Mixer, do not over-mix, as they may break apart causing a reduction in their beneficial properties.

Add fillers in small quantities, especially as you approach the thickness you desire. Resin can thicken suddenly with the addition of very little filler.

Use resins that provide adequate preparation time, Mixing fillers can be a time consuming process which depletes your working time.

Fillers can reduce the shrinkage of polyester resin.

Beware of heat build up during the curing process. Excessive thick layers of resin can get quite hot and possibly damage the surface being bonded.

Experiment with cure times. Fillers can affect the cure times of resins.

Other fillers, besides those mentioned above may be used. Dry sand is an economical filler, which will reduce resin use (and cost), and create a hard abrasion resistant surface. It is excellent for repairing cracks in concrete.

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Using Fillers to Transform Resins

When added to polyester or epoxy resins, fillers can dramatically change the properties of the final product.

Use fillers when you want to:

- thicken resin into putty for patching or filleting
- cause low viscosity resin to hang on a vertical surface
- create an easy-to-sand resin
- reduce the cost of a resin mixture
- strengthen bonding properties
- improve abrasion resistance
- reduce weight, shrinkage, or exothermic heat

Both polyester and epoxy resins readily accept fillers with similar results. When resins with fillers are used for bonding and adhesion, epoxy is recommended because of its adhesive properties. Fillers can affect the pot life of the resin. It is always best to experiment with small quantities first to understand how much working time (pot life) you will have to complete your project.

Where to Use TAP Filler

	Cab-O-Sil	Micro-spheres	Talc	Visco-Fill	Milled Fibers	Chopped Strand
Fillets	Best*	Best*	✔	✔	—	—
Bonding	✔	—	✔	✔	✔	—
Surf/Sailboard Repair	—	✔	—	—	—	—
Fairing	Best*	Best*	✔	—	—	—
Strength	✔	—	—	✔	✔	Best
Sanding	—	Best	✔	—	—	—
Bulking Out	—	✔	—	—	—	—
Reduce Weight	—	✔	—	—	—	—
Vertical Surface	Best	—	—	✔	✔	—
Reduce Shrinkage	—	✔	—	—	✔	Best
Fill Holes	✔	—	—	✔	✔	✔

** Combine Cab-O-Sil and Microspheres, see paragraphs below.*

Safety
Always work in a well ventilated area. Wear a dust mask when working with fillers, and especially when sanding. Avoid skin contact with resins. Wear rubber gloves.

Cab-O-Sil

Cab-O-Sil is a superfine fumed silica. When Cab-O-Sil is added to resin at least three properties of that resin change: viscosity, thixotropy, and bond strength. When used in small amounts (1%-3% by weight or 2 parts resin to 1 part filler by volume), Cab-O-Sil does not significantly change the viscosity but does improve thixotropy, making the resin suitable for vertical applications with minimal run off.

When used in higher concentrations (3%-7% by weight), Cab-O-Sil can transform the viscosity of resin from a *syrup* to a consistency like *peanut butter*. When roughly equal volumes of resin and Cab-O-Sil are mixed, the result is a translucent paste similar to *petroleum jelly*. Experiment to create the consistency you desire.

Thickened resin can be used for hole/gap filling, filleting, and bonding porous and nonporous objects. See below for bonding instructions. Cab-O-Sil creates an extremely hard, somewhat brittle, abrasion-resistant surface. Cured resin with Cab-O-Sil is very difficult to sand, so use care in application to avoid sanding problems. Combine with Microspheres to create a putty-like mixture for sanding.

Talc

Talc is a low cost filler often used to make resin spreadable like a paste or putty. When combined with resin, it cures to a hard, non-flexible product suitable for knot and seam filling, bedding, encapsulation, anchor bolts, tool making, jigs, etc. It increases weight, stiffness, and electrical resistance to resins. While it creates a hard surface, it also makes the resin sandable. If extensive sanding is expected, Microspheres will produce a surface that is easiest to sand. Two parts Talc to one part resin by volume produces a very smooth *peanut butter* consistency.

Visco-Fill II

Visco-Fill is more thixotropic than Talc and can be used for filleting or gap filling. While it has properties similar to Cab-O-Sil, it is easier to handle because its particles do not become airborne. Visco-Fill creates an opaque white finish and is a little more difficult to disperse in resin. The finished surface will be hard, abrasion resistant, and difficult to sand.

Microspheres

Microspheres are just what their name suggests, microscopic hollow glass spheres. By virtue of their shape, microspheres act as tiny ball bearings, providing better flow properties than other fillers. When added to resin they displace the resin with air, creating a thick but very low density compound. Microspheres increase impact resistance, make resin much easier to sand, and are more economical than buying pre-mixed compounds. They are an excellent filler for surf and sail board repairs.

Microspheres will thicken a resin, but even in a thickened state, the resin can sag because Microspheres are not thixotropic. A one-to-one mix by volume will yield a very viscous but flowing liquid. Two parts Microspheres to one part resin creates a consistency like *peanut butter*.

When a resin filled with Microspheres is sanded, the surface becomes porous. So do not use this piece below the water line unless it is sealed with several coats of TAP Premium Marine Grade Epoxy.

Use care when mixing Microspheres with a mechanical mixer. Microspheres are fragile, and excessive mechanical mixing can crush the spheres and destroy their properties.

Milled Fiber

Milled fibers are a fine blend of fibers that thicken resin and give it the strength of glass. The bond-strength and gap-filling properties increase when Milled Fibers are used. Good choice when maximum strength is needed.

Chopped Strand

Chopped Strand uses short (under 1/2″) strands of fiberglass to dramatically increase the strength of resin, especially in bridging gaps. It is not recommended for filleting or where sanding will be required. Reduces shrinkage of polyester resin.

Definitions

Viscosity: The resistance of a fluid to flowing. Water is low viscosity; catsup is high viscosity.

Thixotropic: The tendency of a fluid (whether high or low viscosity) to stay in place until agitated. *Example: A low viscosity (thin) resin may be thixotropic because of its ability to* hang *on a vertical surface without significant sag.*

Viscosity and **thixotropy** are related but not synonymous.

Choosing the Resin

There are many brands of pre-mixed filler/resin compounds. However, mixing your own has two advantages.

1. You can create exactly the properties you desire.
2. By using TAP resins and fillers for your project, you ensure maximum compatibility throughout all parts of the process. This eliminates the problem of one brand product interfering with another brand.

TAP fillers work well with both polyester and epoxy resins. If maximum secondary bonding is essential, epoxy is recommended. If secondary bonding is not as important (such as in filleting, surfboard repair, etc.) then polyester works well and is more economical than epoxy. If the surface being repaired is epoxy, then epoxy MUST be used for the repair in order to achieve an acceptable bond. When bonding to oak, teak, redwood, or mahogany, epoxy is recommended.

TAP has many polyester and epoxy resins. Read the labels and Product Bulletins to decide which resin best suits your purpose. A TAP salesperson will be glad to help you.

How To Use Fillers

Bonding Dense, Nonporous Wood

Bonding nonporous surfaces presents special problems because the substrates (materials being bonded) do not absorb the resin well, creating a weaker bond. Epoxy is recommended for such bonds because of its superior adhesive properties.

To bond such surfaces successfully the following steps are recommended:

- Roughen the surfaces with sand paper (60 grit or courser).
- Be sure there is no surface contamination. Avoid using solvents on the wood.
- Make sure the wood is warm (70 to 80°F) and DRY. Warm wood lowers the viscosity of the resin, promoting better penetration.
- Coat both surfaces with mixed epoxy and allow time for any absorption.
- Thicken the resin/hardener mixture to a consistency like *peanut butter* with Cab-O-Sil.
- Apply the thickened mixture to one of the surfaces.
- Using only moderate pressure, clamp the two surfaces together, being careful not to squeeze all the resin out of the joint as this will weaken the bond.
- To ensure that the two pieces do not squeeze out all the resin, put a layer of fiberglass cloth in the joint. The thickness of the cloth will prevent the two hard surfaces from coming in contact with each other.
- Allow the bond to fully cure before putting in service (7 days for epoxy).
- When possible use woods other than oak, teak, mahogany, and redwood for fiberglass applications.

Fairing

Fairing means filling in low spots of a surface so as to be even with the surrounding area. Fairing compound must be sandable and thixotropic so that it will hang on a vertical surface. To create these properties in resin:

- Mix together approximately one part (by weight) of Cab-O-Sil (for thixotropic properties) to 30 parts (by weight) Microspheres (for sandable properties).
- Add this mixture to resin to create a consistency like *peanut butter*.
- Trowel the compound into the low spots of a properly prepared surface. Force the compound into any voids, being careful to fill all gaps. Leave the surface slightly higher than the surrounding area.
- Allow the mixture to cure overnight. Sand level to the surrounding area using 80 grit sandpaper and a sanding block.
- Apply successive layers of compound if further build up is needed, then sand to fair.
- Seal the surface with the finish of your choice.

Filleting

A fillet is a cove shaped surface that changes an inside right angle to a smooth curve. Fillets provide more bonding surface and a stronger bond. They also provide backing for fiberglassing inside corners.

To create a fillet:

- Mix Cab-O-Sil (or Talc, Visco-Fill, Microspheres) with resin to a consistency like *peanut butter*.
- Apply mixture to the inside corner. If you are currently bonding two pieces, apply the mixture to the surfaces before putting the pieces together. As the pieces are squeezed together, excess mixture will form along the joint.
- Drag the curved end of a stir stick along the inside corner, pulling along excess thickened resin and leaving behind a coved fillet.
- Remove any excess resin with the edge of the stir stick.
- Allow resin to cure and then sand.

Bonding Porous Surfaces

Porous surfaces are often improperly bonded when gaps between surfaces are not filled and the porosity of the surfaces *wicks* the resin out of the joint, leaving the joint *starved* and weak.

To properly bond porous surfaces:

- Mix and apply resin that has not been thickened to both surfaces in need of bonding.
- Watch the surfaces for absorption. As the surfaces absorb the resin, reapply until the surfaces are saturated. The surface will remain shiny wet when saturation is achieved.
- Mix more resin with Cab-O-Sil (or Visco-Fill, or Milled Fibers) to a consistency like *peanut butter*.
- Apply a bead of the mixture along one of the surfaces and clamp the two pieces together. Do not clamp tight enough to squeeze out all the resin.
- Create a fillet for a stronger joint.
- Allow to cure and finish as desired.

Fastening Bolts and Hardware

In marine applications, the hardware that is often fastened with bolts or screws may only penetrate the skin of the fiberglass. A flexible sealant is then used to keep water out, but it adds nothing to the strength of the bond. This places great stress on the screws and can cause delamination. Using epoxy distributes the load over a much greater area.

To do this, remove the hardware and any sealant that remains on either surface. Sand the fiberglass and the metal thoroughly. Mix Cab-O-Sil with epoxy to a consistency like *peanut butter* and apply to the fastener holes and to the base of the piece of hardware. Reattach the hardware with the screws, using firm pressure to squeeze out excess resin, but still leave enough to fill any gaps. Remove excess resin with the edge of a stir stick. Allow to cure at least 24 hours.

If the fiberglass is delaminated or otherwise degraded, consult a TAP Salesperson on repair techniques before replacing the hardware.