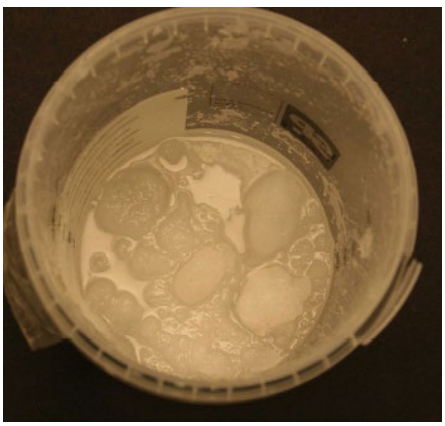
Crystallization of Liquid Epoxy Resins

Crystallization

Epoxy resins, under certain conditions, can become solid or have a slush like appearance. This is called crystallization and it is where some component parts of the epoxy resin form a crystalline structure. If your resin has crystallized you should stop using it until it has been heat treated (see below) as the properties of the remaining liquid will be different than designed.

The crystallization of an epoxy is very similar to water freezing in that it goes from a liquid state to become a solid. And like water once warmed it will revert to its liquid state without any change or damage to the properties of the resin. But unlike water which melts at approximately 0°C the melting point of crystallized epoxy will be in the region of 45°C.



Severely Crystallized resin

How to tell if your resin is affected.

The first signs of crystallization are that the resin becomes cloudy, hazy or “grainy” and the viscosity may increase. These changes are generated by small crystals free floating in the resin. But as the size of the crystals increases the resin becomes more like a slush in that the material will still flow but sluggishly. As this crystallization of the resin increases the slush forms larger lumps.

As the density of the crystallized resin is higher than the material surrounding it sinks to the bottom of the container, building in thickness until the whole container becomes solid.

Why has this happened?

Gurit engineers, through careful formulation, products to be highly resistant to crystallization occurring. However, all epoxy resins can occasionally still crystallize in certain conditions. Factors that affect this include:

Purity

The higher the purity elements of the resin increase the possibility as there are less additives to disrupt the crystalline matrix forming.

Temperature fluctuations

When epoxy resins are stored at low temperatures, it can increase the chance of them reverting to solids. This can be further increased with repeated changes in temperature; the resin being warmed and cooled repeatedly. The thermal cycling helps to orientate the material into the right chemical structure for the material to form crystals. But this should be greatly lessened if the material is stored as directed in the data sheets which normally are between 10°C to 25°C.

The temperature fluctuations that occur between night and day start or enhance the crystal growth process.

Storage Time

Over time, especially when stored at lower temperatures, epoxy resins can revert to their solid form. Therefore, older materials have a higher potential to crystallize. Stock should always be inspected for visual signs of crystallization before use.

Dust & Contamination

The introduction of dust particles into the resin can accelerate the process as it does give the crystallization process a starting point or "seed". And once the process is started it can progress more quickly due to the self-organizing nature of chemistry. Always keep containers closed while not in use to prevent dust contamination, and store in original containers.

How to correct the situation

This process can be reverted for non-filled resin systems such as infusion and laminating resins with no damage to the resin - just like melting water, but the temperature involved will be higher.

In this case you will need to heat the resin ensuring all the container's contents achieves a minimum of 50°C, to surpass the melting point of the crystals, and hold it there until all crystals have completely melted (approximately 1 hour). **Ensure the container can vent as it is heated and cooled otherwise damage may occur to the container.** If any crystals remain, the whole container may become solid again within a few days. Correctly heated resin will retain the full remaining useable shelf life of the product. The resin can be heated between 60-80°C to ensure the coolest point in the container has achieved at least 50°C for the 1 hour. It is advised to place a thermometer to the center of the liquid to monitor the lowest temperature. Once the entire volume of resin is over 50°C the material should be stirred, either with a mixing paddle and/or to rotate the sealed container/drum. Resin should be allowed to cool to room temperature prior to use.

When heating the crystallized resin, the heat will not transfer quickly and achieving a consistent bulk resin temperature will take quite some time, possibly even 2-3 days for drums or IBCs of resin, depending upon the amount of resin within the container. With some resin systems, like the Ampreg range, it is possible to see when the crystallized material has melted as the resin will change from cloudy / grain state to liquid at its original clarity.

The condition of any epoxy resin should be checked before use, if crystallization has occurred then this process can be repeated as many times as needed to keep the resin in good condition.

If you have any questions, please do not hesitate to contact a member of the Customer or Technical Support team.