COMPOSITE ENVISIONS KNOWLEDGE HUB
PRACTICAL AND INSIGHTFUL COMPOSITES INFORMATION

WHY POST CURING MATTERS

COMPOSITE ENVISIONS

WHY POST CURING MATTERS

STANDARD AIR CURING

Resin systems have an array of cure mechanisms ranging from room temperature to nearly 500 F. To simplify these resins, there are generally 2 categories, room temperature cure and those that require heat (above room temp) in order to cure. Many 2-part systems are formulated for simplicity, mix part A & B together and let sit for “x” number of hours and boom. Finished composite.

Standard air cure is a much cheaper option when fabricating parts. Air cure generally excludes the need for equipment such as ovens, possible complex bagging schemes, heat lamps and the time it takes to optimize a heat curing system. All of which can be costly in an economic perspective. Not having to provide heat simply offers an easier way of fabricating a composite. However, Room Temperature Cure comes with a trade-off of higher material characteristics.

POST CURING

The post cure of a composite part is the process using heat to expose the part to elevated temperatures. This process can speed up the cure process and/or maximize the composites final material properties. Post cure processes are usually performed within ~12 hours after the initial cure has taken place. As most thermoset resins fully cure between 7-10 days, they can be exposed to certain elevated temperatures to achieve better material characteristics. These characteristics are enhanced by increasing the crosslinking, thus aligning the polymer’s molecules into a more crystalline structure. Always post cure to manufacturer’s specification in order not to exceed the temperature capabilities of the resin.

Note: After the initial air cure of 7-10 days, post curing will not have any increased benefit to the parts.

The glass transition temperature of a composite will be affected by its final cure parameters and thus will not be much higher than of its cure temperature. Use of a post curing mechanism in certain epoxy resins for example, if heat were added for an hour at 150F after overnight room temperature cure, the temperature resistance of that composite could increase by 10-15%. Adding heat for longer could result in a part that has nearly 20% better service temperatures in certain applications.

Physical properties such as modulus, tensile and compressive strengths could be affected by up to nearly 20% as well. Chemical resistance properties of laminates will also go up by heat application when curing. Even electrical conductivity in carbon fiber laminates can be affected by post-cure due to increased crosslinking.

Placement of parts during Post Cure regarding in-mold or leaving the part free standing during the post cure depends on if the layup tool can be subjected to the temperatures.

WHY POST CURING MATTERS

Make sure the tool's material can withstand such temperatures it would be exposed to during a post cure cycle. It is best practice to complete the post cure using the layup mold still bagged and under vacuum pressure. If the part cannot be placed in the oven with the layup mold, parts can be placed in an "free standing" depending on how heavy or big the parts are. Although points of sagging or deformation can occur, using temperature capable tools to keep the part in a steady state or supported will aid in mitigating possible warpage that could occur. It is safe to use the sun to post cure the laminate but understanding the variables should be noted for before use. If possible, use the layup mold with the part still under vacuum in a bag. The part may heat up at inconsistent rates due to factors such as shade and rates that the tool may heat the part's surface.

Testing data for a given system is usually found in the resin's technical data sheets. Found are general properties such as strength, modulus, Tg, heat distortion, and many others. Most of these tests are provided in which a resin has been post cured and most Technical Data Sheets (TDS) will show the conditions of cure. Displayed numbers on a TDS are a system's optimum numbers. Generally, the manufacturer of a resin system are going to want to place the best numbers for a resin system and how it is cured gives these optimal numbers. In other words, if a technical data sheet shows that the part has been post cured for a given amount of time, they know this to give the composite optimum properties. If an air cure alone is completed, composite properties could fall as much as 20% in a laminate.

With the information given, it is important to understand that the needs of performance vary per part. Often, a straight air cure will provide the needed performance values of a composite. Optimal performance is very nice to have, although that need completely goes with performance requirements of a composite laminate.

Composite Envisions LLC
8450 Development Court
Wausau, WI 54401 USA
+1 715-842-0101
info@compositeenvisions.com
https://compositeenvisions.com/

COMPOSITE ENVISIONS