Prepreg Process Defined

Prepregs are used in: Aerospace, Defense / Ballistics, Marine, Transportation, Wind Energy / Power

Prepregs are used in high-performance applications where weight and mechanical properties take precedence over cost. High-end epoxy resins and carbon fiber, aramid or other advanced fibers are commonly used in prepreg structures.

Prepregs are reinforcement materials that have been pre-impregnated with either a thermoplastic or thermoset resin, hence the name prepreg. The resin impregnation process precisely controls the fiber to resin ratio and ply thickness. Thermoset prepregs are produced by saturating a fiber reinforcement with a liquid thermoset resin. Excess resin is removed from the reinforcement and the resin undergoes a partial curing, changing from a liquid to a pliable solid state. This is known as the “B-stage.” Prepregs in the B-stage require refrigerated storage conditions. The curing process is then activated with the application of heat.

Thermoplastic prepregs are produced by coating fiber reinforcement with a thermoplastic matrix. An advantage to thermoplastic prepregs is the ability to reheat and reform the material multiple times by heating above the melting point of the specific thermoplastic matrix. Unlike thermoset prepregs, thermoplastic prepregs can be stored at room temperature. In this case the thermoplastic prepreg is formed by heat and becomes solid when cooling to room temperature.

Plies of prepregs materials are laid-up in a tool by hand or with automated equipment. The laminate stack is then consolidated under the pressure of a vacuum bag. The curing process is triggered by the application heat in a heated tool, in an oven, or in an autoclave where heat and high pressure are applied. Thermoset prepregs require a controlled heat cycle for curing that allows for the appropriate resin flow within the laminate and then polymerization to the cured state. This typically involves a controlled heating rate and soak at specified temperature with controlled cool down. Thermoplastic prepregs do not rely on a crosslinking reaction and can typically cycle more quickly. Both thermoset and thermoplastic prepregs create lightweight high strength composite laminates.