Injection Repair of Carbon Fiber/Bismaleimide Composite Panels with Bisphenol E Cyanate Ester Resin

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Supporting information

Injection Repair Setup and Procedures

The injection repair setup shown in Figure S1 was primarily devised to achieve effective infiltration of the resin into the delamination area. It was equipped with dual vacuum ports to remove air from the microscopic cracks in the composite that could inhibit resin infiltration. Constant pressure was applied during the resin injection process using a compressed air pressure cylinder above the injection syringe. Heating elements and a thermocouple were attached under the specimen to maintain optimum repair temperature (70°C) in the specimen. Prior to repair, freshly prepared BECy resin was degassed and placed in a convection oven at 100°C for five minutes to lower its viscosity. The delaminated specimen was secured tightly inside the vacuum chamber and heated to 70°C to help maintain low resin viscosity as it was injected. The temperature of the panel was monitored by conning thermocouples on the surface of the specimen close to the injection site. A vacuum of approximately 25 mm Hg was applied to the entire specimen to remove any air trapped between the delaminated layers and to support infiltration of resin into the fine cracks.
Once the pressure and temperatures were established, the vacuum ports were closed and the resin was injected by the syringe, simultaneously. The injection pressure of the resin was steadily increased to 20 psi and held for several minutes. Pressure was increased up to 30 psi until resin was seen in the vent holes. Once a constant pressure was reached, the resin was allowed to infiltrate for 5-10 minutes or until most of the vent holes were filled. The injection syringe filled with 5 ml of resin was observed to be sufficient for the repair. The holes were typically filled within a time span of 30 s to 5 min. Once injection was completed, the pressure was released, and the specimen was removed and wiped to clean excess resin from the surface. All vent holes were refilled with resin before curing the specimen for two hours at 180°C.
Figure S1: Setup used for the injection repair process