

Mechanical Behavior of Hybrid Hemp/Jute Fibers Reinforced Polymer Composites at Liquid Nitrogen Temperature

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Abstract : Natural fibers as reinforcement in polymer matrix material is gaining lot of attention in recent years, as they are light in weight, less in cost, and ecologically advanced surrogate material to glass and carbon fibers in composites. Natural fibers like jute, sisal, coir, hemp, banana etc. have attracted substantial importance as a potential structural material because of its attractive features along with its good mechanical properties. Cryogenic applications of natural fiber reinforced polymer composites like cryogenic wind tunnels, cryogenic transport vessels, support structures in space shuttles and rockets are gaining importance. In these unique cryogenic applications, the requirements of polymer composites are extremely severe and complicated. These materials need to possess good mechanical and physical properties at cryogenic temperatures such as liquid helium (4.2 K), liquid hydrogen (20 K), liquid nitrogen (77 K), and liquid oxygen (90 K) temperatures, etc., to meet the high requirements by the cryogenic engineering applications. The objective of this work is to investigate the mechanical behavior of hybrid hemp/jute fibers reinforced epoxy composite material at liquid nitrogen temperature. Hemp and Jute fibers are used as reinforcement material as they have high specific strength, stiffness and good adhering property and has the potential to replace the synthetic fibers. Hybrid hemp/jute fibers reinforced polymer composite is prepared by hand lay-up method and test specimens are cut according to ASTM standards. These test specimens are dipped in liquid nitrogen for different time durations. The tensile properties, flexural properties and impact strength of the specimen are tested immediately after the specimens are removed from liquid nitrogen container. The experimental results indicate that the cryogenic treatment of the polymer composite has a significant effect on the mechanical properties of this material. The tensile properties and flexural properties of the hybrid hemp/jute fibers epoxy composite at liquid nitrogen temperature is higher than at room temperature. The impact strength of the material decreased after subjecting it to liquid nitrogen temperature.

Keywords : liquid nitrogen temperature, polymer composite, tensile properties, flexural properties

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