Loading rate sensitivity of liquid nitrogen conditioned glass fiber reinforced polymeric composites: An emphasis on tensile and thermal responses

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ABSTRACT

Glass fiber reinforced polymeric (GFRP) composites are being accepted as potential materials for ultra-low temperature applications. The current investigation is to evaluate effect of liquid nitrogen (LN_2) conditioning (for different intervals of time) on the loading rate sensitivity of tensile response of GFRP composites. In order to assess this, tensile tests of the unconditioned and conditioned specimens were carried out at different crosshead speeds viz. 1, 10, 100, 500, and 1000 mm/min. At 1 mm/min crosshead speed, an improvement of 3.33% and 7.3% ultimate tensile strength (UTS) value was observed in case of 0.25 and 1 h conditioned GFRP composites, respectively, as compared to unconditioned GFRP composites. Similarly, the specimens tested at 1000 mm/min show an improvement of 11.39% and 12.02% UTS for 0.25 and 1 h LN_2 conditioned GFRP composites, respectively, as compared to unconditioned GFRP composites. Effect of LN_2 conditioning on crosshead speed sensitivity of modulus and strain at break are also reported. The in-service temperature of the GFRP composite was measured using temperature modulated differential scanning calorimetry. Furthermore, dynamic mechanical thermal analyzer was used in the temperature range (40–200 °C) to correlate the mechanical and thermomechanical response of the GFRP composites. More in Wiley Periodicals, Inc. Journal of Applied. Polymer Science 2018, 135, 45856, https://doi.org/10.1002/app.45856