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HIGH STRAIN RATE SENSITIVITY OF GLASS/EPOXY/CLAY NANOCOMPOSITES

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Summary: In general, composite materials are rate sensitive to their mechanical properties. In order to determine these properties, dynamic tensile tests are performed on drop mass test setup, which provides mechanical data at strain rates up to 1000 s-1, filling the gap between conventional low speed instruments and split Hopkinson bar tests. The present research work is to study the effect of strain rate on the tensile behavior of glass/epoxy and its clay nanocomposites. The clay in terms of 1.5, 3 and 5 wt% are dispersed in the epoxy resin using mechanical stirrer followed by sonication process and glass/epoxy nanocomposites are prepared by hand layup technique followed by compression molding technique. Characterization of the nanoclay is performed using X-ray Diffraction (XRD) and Scanning Electron Microscopy (SEM). The Digital Image Correlation (DIC) technique is used for full field measurement of strain and strain rate using high speed camera. An array of 128 X 128 pixels is used to achieve 100,000 frames per second for obtaining dynamic strain. Stress strain measurements are reported for glass/epoxy and its clay nanocomposites over a range of strain rates from 0.0016 to 450 s-1 and the variation of tensile modulus, strength and failure strain with strain rate are studied. The tensile modulus (18 GPa) and tensile strength (315 MPa) increase significantly up to 106% (37 GPa) and 67% (526 MPa), respectively at the highest strain rate for neat glass/epoxy composite. It is observed that the tensile modulus increases monotonically as the clay loading increases and 1.5 wt% clay loading found as optimal loading for tensile strength.