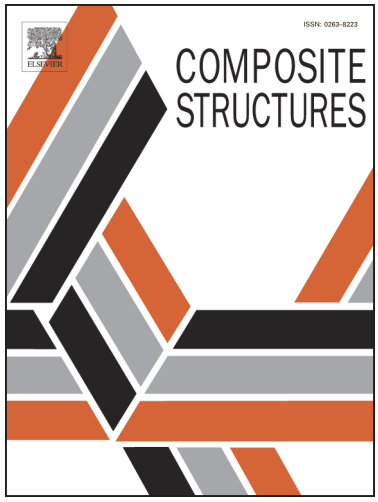

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Effect of strain rate on mechanical properties of the bamboo material under quasi-static and dynamic loading condition

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Abstract

As a kind of fiber-reinforced bio-composite, bamboo material exhibits superior mechanical performance. In present work, quasi-static and dynamic Split Hopkinson Pressure Bar (SHPB) compression experiments at the nominal strain rate range of 500 s^{-1} ~2200 s^{-1} were carried out to investigate the effect of strain rate on mechanical behaviors of the bamboo material. In consideration of the effect of fiber directions on mechanical behaviors, the specimens were crushed with the loading direction parallel to the fiber longitudinal direction and perpendicular to the fiber direction, respectively. The experiments under both loading directions exhibited remarkable strain rate sensitivity. The yield stress for the specimens crushed along the fiber longitudinal direction increased from 38.59 MPa to 94.25 MPa, as the strain rate varied from 1.85×10^{-3} to 2200 s^{-1}, while it increased from 7.18 MPa to 42.04 MPa for the specimens crushed perpendicularly to the fiber direction. Final deformation photographs and scanning electron micrographs of the bamboo microstructures clearly illustrated their damage morphologies and various failure mechanisms, including fiber buckling, fiber fractures, PCs collapse, delamination and crack propagation at different strain rates and loading directions. These results may provide

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