Effect of the strengthened ribs in hybrid toughned kenaf/glass epoxy composites bumper beam.

Abstract

The growth of car production governs new environmental regulations “End-of Life Vehicles” (ELV) to enforce car manufacturer to substitute synthetic material to bio based materials. Low mechanical properties of natural fibre composite confine their application in automotive non-structural components. Hybridizations of kenaf with glass fibre along with epoxy PBT toughening did not completely fulfill the required impact property of the developed bio-composite bumper beam to substitute with typical material of the bumper beam glass mat thermoplastic (GMT). Therefore, in the first stage of the geometrical improvement “concept selection” concluded that the double hat profile (DHP) is the most suitable concept out of eight bumper beam concepts when six parameters with different weight (strain energy, deflection, weight, cost, manufacturing and rib possibility) are determined. In second trial, the usage of strengthen rib is employed to improve the impact property and performance of the bumper beam for utilization of hybrid kenaf/glass fibre as a car bumper beam. The low-speed impact test based on the (ECE R42) regulation is modeled. Eight vertical ribs with thickness 4 mm are located along the bumper beam. The pendulum hit to the middle of the bumper, while it is fixed to the vehicle chassis through two energy absorbers. The strain energy and deflection were determined and compared with the same profile, but in un-ribbed condition. It is concluded that the ribbed bumper beam decrease the deflection of the bumper beam by 11% and strain energy by 11.3%. The ribbed bumper beam increases the structural safety factor and its reliability for utilization in automotive structural components.

Keyword: Bumper beam; Finite element analysis; Hybrid material; Natural fibre composite