World Academy of Science, Engineering and Technology
International Journal of Materials and Textile Engineering
Vol:14, No:02, 2020

The Effect of Honeycomb Core Thickness on the Repeated Low-Velocity Impact Behavior of Sandwich Beams

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Abstract : In a recent study, a new bio-inspired honeycomb sandwich beam (BHSB) mimicking the head configuration of the woodpecker was developed. The beam consists of two carbon/epoxy composite face sheets, aluminum honeycomb core, and rubber core to enhance the repeated low-velocity impact resistance of sandwich structures. This paper aims to numerically enhance the repeated low-velocity impact resistance of the BHSB via optimizing the aluminum honeycomb core thickness. The beam was investigated employing three core thicknesses: 20 mm, 25 mm, and 30 mm at three impact energy levels (13.5 J, 15.55 J, 21.43 J). The results revealed that increasing the thickness of the aluminum honeycomb core to a certain level enhances the sandwich beam stiffness. The beam with the 25 mm honeycomb core thickness was the only beam that can sustain five repeated impacts achieving the highest impact resistance efficiency index, especially at high energy levels. Furthermore, the bottom face sheet of this beam developed the lowest stresses indicating that this thickness has a relatively better performance during impact events since it allowed minimal stress to reach the bottom face sheet. Overall, increasing the aluminum core thickness will increase the height of its cells subjecting it to buckling phenomenon. Therefore, this study suggests that the optimal thickness of the aluminum honeycomb core should be 65 % of the overall thickness of the sandwich beam to have the best impact resistance.

Keywords : sandwich beams, core thickness, impact behavior, finite element analysis, modeling
Conference Title : ICCMS 2020 : International Conference on Composite Materials and Structures
Conference Location : Amsterdam, Netherlands
Conference Dates : February 06-07, 2020