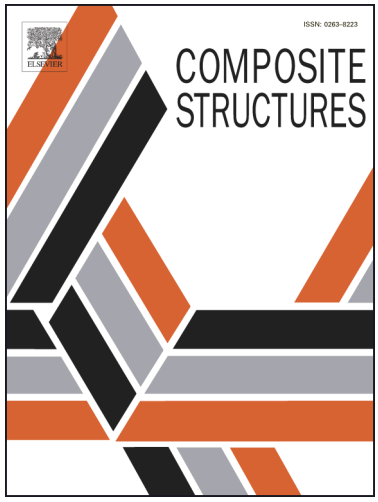

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PII: S0263-8223(17)33917-X
DOI: https://doi.org/10.1016/j.compstruct.2018.01.044
Reference: COST 9284

To appear in: *Composite Structures*

Received Date: 23 November 2017
Revised Date: 9 January 2018
Accepted Date: 12 January 2018

Please cite this article as: Lee, D-W., Park, B-J., Park, S-y., Choi, C-H., Song, J-I., Fabrication of High-Stiffness Fiber-Metal Laminates and Study of Their Behavior Under Low-Velocity Impact Loadings, *Composite Structures* (2018), doi: https://doi.org/10.1016/j.compstruct.2018.01.044

Fabrication of High-Stiffness Fiber-Metal Laminates and Study of Their Behavior Under Low-Velocity Impact Loadings

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Abstract

This study investigates the impact behavior of fiber-metal laminates (FMLs) (Carbon FMLs and Glass FMLs), which were fabricated by using high-stiffness steel, carbon prepreg, and glass prepreg through autoclave molding. The mechanical behavior of the FMLs was evaluated by performing tensile, compressive, in-plane shear, and low-velocity impact tests. Drop-weight impact tests were conducted to induce cracking of the FMLs, and the crack initiation along with crack propagation behavior of the different laminate sequences ([0/0], [0/90], [0/90/0], [90/0/90] and [0/90/90/0]) were also studied. The results show that the fabricated FMLs have higher strength and stiffness than conventional FMLs. Their impact strengths increased, and weights decreased simultaneously. The absorption energy was proportional to the crack length that was induced by the low-velocity impact. Moreover, it was found that the fiber orientation mainly affected the direction of crack propagation in the FMLs. This investigation facilitates the design of high-stiffness and lightweight FMLs for automotive parts.

Keyword: High stiffness; Fiber-metal laminates; Glass/carbon prepreg; Low-velocity impact; Drop-weight impact test; Absorbed energy

Nomenclature

[S/0/0/S], [S/0/90/S], [S/0/90/0/S], [S/90/0/90/S] and [S/0/90/90/0/S]: ‘S’ represents the steel sheet which used in Fiber-Metal Laminates (FMLs) as high-stiffness materials. ‘0’ and ‘90’ represent the fiber direction of the prepreg in FMLs. For example, [S/0/0/S] is the meaning that steel sheet and prepreg are laminated in the order of steel, prepreg (0°), prepreg (0°) and steel.