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Impact damage growth in carbon fibre aluminium laminates

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Abstract

The paper presents an analysis of the response of fibre metal laminate based on aluminium and carbon fibre reinforced polymer to low-velocity impact. The comparison of the force–time dependencies with the actual effects of the indenter–laminate system (using high-speed cameras) contributed to the identification of the representative points and ranges that determine characteristic changes in the laminate structure in terms of damage and specific forms of its degradation. The authors proposed five damage states of aluminium-carbon laminate during low-velocity impact. The initial stages of the damage is associated with internal degradation and plastic deformation of the laminate until the impact resistance of the fibre metal laminates indicated by the authors. Matrix cracks, delaminations between composite layers with different orientation, as well as delaminations at the metal/composite interface are the characteristic damage modes. The catastrophic failure with cracking of the aluminum layers and composite materials and impactor penetration of the hybrid laminate are the next stages. Identifying damage initiation, propagation and its stages in live-time analysis of an aluminium-carbon laminate under impact may lead to making progress in this kind of laminates and understanding and interpretation of the impact phenomena.

Keywords: carbon fibres, hybrid composites, impact behaviour, damage mechanics

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