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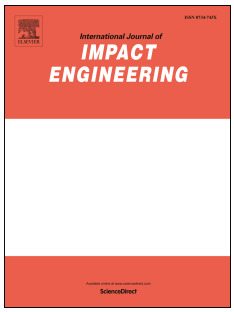

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Damage in single lap joints of woven fabric reinforced polymeric composites subjected to transverse impact loading

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Abstract

Single lap joints of woven glass fabric reinforced phenolic composites, having four different overlap widths, were impacted transversely using a hemispherical impactor with different velocities in the low velocity impact range. The resulting damage was observed at various length scales (from micro to macro) using transmission photography, ultrasonic c-scan and x-ray micro tomography (XMT), in support of each other. These experimental observations were used for classification of damage in terms of damage scale, location (i.e. ply, interfaces between plies or bond failure between the two adherends) and mechanisms, with changing overlap width and impact velocity. In addition, finite element analysis was used to simulate delamination and disbond failure. These simulations were used to further explain the observed dependence of damage on overlap width and impact velocity. The results from these experiments and simulations lead to the proposal of a concept of lower and upper characteristic overlap width. These bounds relate the dominant damage pattern (i.e. scale, location and mechanism) with overlap width of the joint for a given impact velocity range.

Keywords:

Composite Joints; Impact Damage; Disbond; Delamination Modelling; X-ray Micro Tomography

1. Introduction

Joints formed through adhesive bonding or co-curing of composite laminates are often used to form part assemblies for various applications. An important aspect to consider when designing joints having composite adherends is that the joint or bond interface can have material properties similar to the