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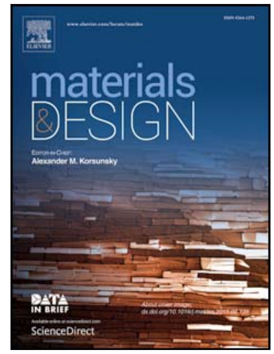

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Intrinsic cohesive modeling of impact fracture behavior of laminated glass

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Abstract

Automotive laminated glass is generally composed of two pieces of outer glass layers and one piece of polyvinyl butyral (PVB) interlayer. Its impact fracture behavior is very important to the safety of drivers, passengers and pedestrians. The objective of this work is to numerically investigate the impact fracture behavior of laminated glass via an intrinsic cohesive model (CM). To achieve this end, we propose a laminated glass model by inserting cohesive elements on all common surfaces of solid finite elements (FEs) in glass layers prior to simulations and describing the nonlinear characteristic of PVB by using the generalized Mooney-Rivlin (MR) model. Besides, the difference between this MR model and another one commonly used MR model is investigated. Then, the impact fracture process of a laminated glass plate is simulated, and the proposed approach is verified by comparing the numerical results with the corresponding experimental observations. Afterwards, parametric studies are performed to investigate the influence of the cohesive penalty stiffness and the strength of glass. Finally, the effects of the stiffness of the PVB film, the support conditions and the thicknesses of glass layers on the impact force history, the cracking and the kinetic energy loss of the impactor are investigated.

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