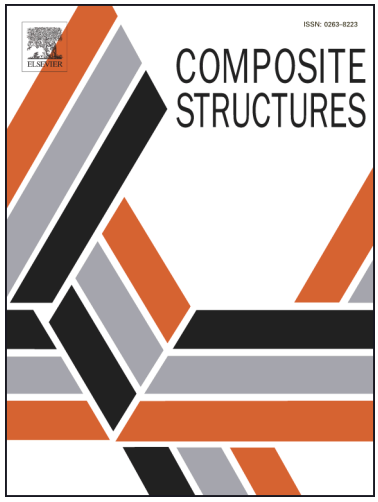

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PII: S0263-8223(18)31529-0
DOI: https://doi.org/10.1016/j.compstruct.2018.09.009
Reference: COST 10155

To appear in: *Composite Structures*

Received Date: 25 April 2018
Revised Date: 18 August 2018
Accepted Date: 14 September 2018

Please cite this article as: Peng, Y., Ma, W., Wang, S., Wang, K., Gao, G., Investigation of the fracture behaviors of windshield laminated glass used in high-speed trains, *Composite Structures* (2018), doi: https://doi.org/10.1016/j.compstruct.2018.09.009

Investigation of the fracture behaviors of windshield laminated glass used in high-speed trains

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Abstract

The objective of this study is to investigate the fracture behaviors of windshield laminated glass for high-speed trains. For this purpose, tempered glass specimens sampled from constituent components of polyvinyl butyral (PVB) laminated windshield panes were tested using the following tests: flexural strength test, quasi-static uniaxial tensile test, low strain rate compression test and dynamic compressive test with split Hopkinson pressure bar (SHPB). Together with simulations, the testing results were used to determine the constitutive constants of the Johnson-Holmquist ceramic (JHC) model, including the equation of state, the strength criterion and the strain-rate effect. To validate the JHC model, it is used to simulate a safety hammer impact test on PVB-Laminated tempered glass (PVB-LTG). The simulation results showed that the JHC model with tempered material constants for PVB-LTG successfully predicted the impact response of windshields. The practical implications of fragmentation and cracking are also discussed.

Keywords: PVB-laminated windshield; tempered glass; mechanical properties; impact responses.
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1. Introduction

As a key component of rail vehicles, windshields are increasing in demand because of their functions. One important function of a windshield is the ability to resist certain impacts; this impact resistance can protect the occupant's safety during traffic operation by preventing external projectiles from being thrown into the carriage. Another function of a windshield is to serve as an emergency escape exit to allow occupants to flee from danger quickly to get emergency medical treatment after a train accident. Therefore, it is very important to properly study the mechanical properties and failure characteristics of a windshield for high-speed trains.