

Dynamic Response of Thin Tempered Laminated Glass Plates under Impact Loading (Postprint)

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Abstract

To address the issue of wind-sand impact on tempered laminated glass in engineering applications, the deflection function of a simply supported elastic rectangular laminated thin plate under impact loading was constructed using double trigonometric series. The coefficients of the deflection function were solved via the integral transform method, and the stress and strain functions of rectangular tempered laminated glass thin plates under simply supported conditions were derived based on the small-deflection bending theory of thin plates. The distribution patterns were computed through Matlab programming to investigate the dynamic characteristics of tempered laminated glass under impact. The results indicate that: under varying impact heights, both impact force and displacement response demonstrate a trend of initially increasing and subsequently decreasing; moreover, due to impact inertia effects, the displacement response is partitioned into contact loading, contact unloading, and post-separation phases; stress waves propagate symmetrically outward within the glass with continuous attenuation, resulting in symmetric distributions of the displacement, strain, and stress fields, with the impact load exerting the most significant influence at the impact point; in the tempered laminated glass thin plate, the lower surface of the impact region experiences tensile failure under tension, while the boundary region undergoes compressive failure under compression, with the failure pattern on the upper surface being exactly opposite. These findings provide an important foundation for investigating the impact failure mechanism of laminated glass.

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