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Dynamic Failure of Honeycomb-core Sandwich Structures Subjected to Underwater Impulsive Loads

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Abstract: The aluminum sandwich structures with hexagonal honeycomb cores subjected to water-based impulsive loading are studied experimentally. The blast resistance in terms of dynamic deformation, failure modes and associated mechanisms is evaluated in relation to the load intensity, core relative density under air-backed and water-backed conditions. 3D digital imaging correlation and postmortem analysis are used to investigate the deformation and failure of individual components, focusing on the effects of loading intensities, core relative density and loaded condition. The failure mode maps of sandwich panels are summarized to study the different regimes of deflection resistance in different experimental cases. The results show that the effect of relative core density significantly influences the blast resistance of sandwich panels under the different loaded conditions. The sandwich panels with denser cores perform better blast resistance at high impulsive loads under air-backed condition. Only slight discrepancy of deflection resistance has been observed under the water-backed condition. The honeycomb sandwich panels suffer significantly smaller backface deflections than solid plates of identical mass per area under air-backed condition, while the discrepancy of deflection is negligible under the water-backed condition.

Keywords: dynamic failure; fluid-structure interactions; blast resistance; honeycomb sandwich structure; experimental analysis.

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