

COMPARATIVE EVALUATION OF BONDED, WELDED AND WELD-BONDED STRUCTURAL JOINTS

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ABSTRACT

A variety of methods to join structural components is available nowadays. Joining with high-strength adhesives is presently widespread for advanced structures such as aerospace or aeronautical, on account of a few distinctive advantages over traditional methods (elimination of drilling operations and distribution of loads over a larger area than mechanical joints). Nonetheless, stress concentrations emerge at the overlap ends because of the adherends straining and load asymmetry, which can result on premature fractures. Structural joints can equally be severely affected by the surface treatment of the bonding surfaces, extreme environmental conditions and ageing. Weld-bonded joints (combination of adhesive bonding with spot-welding) can surpass these disadvantages, adding a superior static strength and stiffness, and higher peeling and fatigue strength. This work presents an experimental and numerical study comparing hybrid spot-welded/bonded single-lap joints with purely spot-welded and bonded joints. The Finite Element Method (FEM) and Cohesive Zone Models (CZM's) for damage growth were tested in Abaqus® to evaluate this technique for strength prediction. Strength improvements up to 58% compared to spot-welded joints and 24% over bonded joints were achieved by this hybrid method, with accurate FEM estimations.

KEY WORDS: Weld-bonded joints, finite element method, structural adhesive.

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