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.

REFERENCES

The condition of weld metal, welded joints, and weldments after welding and prior to any subsequent thermal, mechanical, or chemical treatments. Atomic hydrogen welding: An arc welding process in which fusion is obtained by heating with an arc maintained between two metal electrodes in an atmosphere of hydrogen. 1.2 Welded joints and welding sequences shall be designed to minimize residual weld stresses and avoid excessive deformation. Welded joints should therefore not be over-dimensioned. 1.3 Welded joints shall be designed to ensure that the proposed weld type and quality (e.g. complete root fusion in the case of single- and double-bevel butt welds) can be satisfactorily achieved under the given fabricating conditions. Welding of cold-formed sections of (hull) structural steels is permissible provided that the conditions stated in Chapter 3, Section 1, G.8. are complied with. In special cases, post-weld heat treatment may be necessary or documentary proof of adequate toughness after welding may be demanded. 9. Other design measures. The most popular weld is the fillet weld, named after its cross-sectional shape. Other types of welds include flange welds, plug welds, slot welds, seam welds, surfacing welds, and backing welds. Joints are combined with welds to make weld joints. If you are new to MIG welding and would like simple training so you can learn quickly, without the headaches, then download my FREE beginner’s guide to MIG welding.