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Fracture mechanics properties of Al/Steel Structural Transition Joints for shipbuilding

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The need of lowering the weight of ships makes it crucial to have superstructures made of aluminum alloy and the ship hull made of steel. Within this context, the connection between the two different metals becomes crucial as different metals are hardly weldable using traditional techniques. Thus Structural Transition Joints are extremely important. One of the most promising welding techniques is the Explosion Welding process, which reaches a good compromise between weldability and mechanical properties of Structural Transition Joints. In the present study, the mechanical behaviour of Structural Transition Joints made of ASTM A516 structural steel, clad by explosion welding with AA5086 aluminum alloy and provided with an intermediate layer of pure aluminum was investigated. Preliminary fracture mechanics tests on CT Specimens made of Al alloy and shipbuilding grade steel were performed. Afterwards, fracture mechanics properties of the Structural Transition Joint considering a notch located at the interface between the pure aluminum and steel were evaluated experimentally following the current standards. In addition, the Digital Image Correlation technique allowed the analysis of the displacement and strain patterns of the different metals and to evaluate the crack length of the bimetallic specimen.

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