

CHARACTERIZATION OF VACUUM EXPLOSIVE WELDED JOINTS BETWEEN TITANIUM AND STAINLESS STEEL FOR VACUUM APPLICATIONS

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ABSTRACT

A two-layered vacuum explosive welded (EXW) plate, consisting of titanium-grade 1/stainless steel 304L (Ti/304L), was investigated for vacuum applications. The interface of the Ti/304L displayed a wavy shape characteristic of the EXW method, which reflects the existence of mass transfer during bonding. The aim of this study was to examine the feasibility of using Ti/304L EXW joints for vacuum application. The Ti/304L EXW plate was examined by non-destructive and destructive metallurgical methods, including visual testing, scanning acoustic testing, light microscopy and metallography, SEM-EDS examination, microindentation hardness measurements, ram tensile test, fractography, and leak testing. According to the metallurgical testing methods, the formation of brittle intermetallic phases took place adjacent to the bonding interface. The intermetallic phases formed at the interface of the Ti/304L, behave as the weakest part in the joint, and determine the brittle type of fracture received under tensile stresses. The measured typical tensile strength of the joint is around 300 MPa, similar to that of the Ti 1 alloy. Based on the leak test results, the examined EXW Ti/304L components were found to be feasible for vacuum applications.

KEYWORDS: vacuum EXW, solid state welding, metallurgical bonding, stainless steel, titanium, vacuum applications.

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