

Strength and fracture characteristics of SUS304/AL-Alloy scarf adhesive joint with various adhesive thicknesses

Abstract

In this study, strength and fracture toughness of epoxy adhesively bonded scarf joints of dissimilar adherends, namely SUS304 stainless steel and YH75 aluminium alloy are examined on several scarf angles and various bond thicknesses under uniaxial tensile loading. Scarf angles, $\theta = 45^\circ$, 60° and 75° are employed. The bond thickness, t between dissimilar metals is controlled to be ranged between 0.1 mm to 1.2 mm. Finite element (FE) analysis is also executed to investigate the stress distributions in the scarf joints by ANSYS 11 code. From analytical solutions, stress singularity exists most pronouncedly at the steel/adhesive interface corner of joints having 45° to 75° scarf angle. This is not only in agreement with the FE analyses results but also confirmed by fracture surfaces observation wherein the fracture has always been initiated at this point. The strength of scarf joints increases as the bond thickness decreases. Interface corner toughness, H_c approach can be applied when predicting the failure stress of scarf joints. Besides, for scarf joints with an interfacial crack, the fracture toughness, J_c values are independent of bond thickness and less sensitive to adherends. Moreover, J_c increases as mode mixity increases.

Keywords — Adhesive joint, dissimilar adherend, finite element (FE), fracture toughness, interface crack