

3D finite element stress analysis of butt adhesively bonded dissimilar joint: effect of bond thickness on strength

Abstract

The butt joint is the most studied type of adhesive joints in the literature. However, the joint strength prediction of joints is still a controversial issue as it involves a lot of factors that are difficult to quantify such as the yielding of the adherend, the plasticity of the adhesive and the bondline thickness. The present work is concerned with the three dimensional (3D) finite element stress analysis of butt adhesively bonded dissimilar joint. The objective of the present study was to analyse the effect of bond thickness on mechanical strength of butt adhesively bonded dissimilar joint. Aluminum alloy and steel were selected and five thicknesses were studied for each adherend: 0.2, 0.4, 0.6, 0.8, and 1.0 mm respectively. In order to quantify the influence of bondline thickness, adherend and durability of the butt joint, the 3D finite element models of ANSYS used to obtain the stress distributions. Mechanical properties of adhesive were determined by tensile test and ANSYS analysis. A statistical analysis of simulation results shows that the butt joint strength becomes stronger while the bondline gets thinner and adhesive gets tougher.

Keywords — Stress distribution, bondline thickness, butt joint, ANSYS