Utilising Energy Dispersive Synchrotron X-ray Diffraction for Characterising Stresses in Two-Phase Titanium Linear Friction Welds

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ABSTRACT

Linear Friction Welding (LFW) is a novel welding technology, which utilises a combination of frictional heating and plastic deformation to join difficult-to-weld materials. However, when joining high temperature materials large residual stresses are generated, which can be detrimental to the joint properties, requiring development of an appropriate post weld heat treatment. In this work, the influence of LFW process parameters (pressure, amplitude, and frequency, as well as the post-weld heat treatment) on the residual stress development in β-forged Ti-6246 aerospace alloy was investigated at the European Synchrotron Radiation Facility (ESRF) in Grenoble, France, using energy dispersive X-ray diffraction. As Ti-6246 is a two-phase alloy, calculating the stresses in the alloy required the measurement of strain in both phases separately. The advantages and limitations of this technique, with respect to resolution and accuracy, are highlighted and discussed.