

Evaluation of Residual Stress in Self-Pierce Riveted Joints by Neutron Diffraction and Transmission Measurements

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Self-Pierce Riveting (SPR) is a mechanical fastening technique for joining sheet materials. It is increasingly replacing resistance spot welding in the automotive industry for the assembly of lightweight structures made of advanced or dissimilar materials that are difficult and sometimes impossible to join by welding. The production of joints by SPR involves high pressures and large plastic deformation at high strain rate in both the sheet materials and the rivets. Knowledge of the resulting state of stress in the materials is important to understanding the performance of the joints.

In this work, the challenges and uncertainties involved in measuring residual stresses in SPR joints using the neutron diffraction and transmission techniques are discussed. Even though small sizes were involved, meaningful results were obtained, and measurement errors were reduced by optimising instrument parameters.

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