RESIDUAL STRESS DETERMINATION IN AZ31 FRICTION STIR WELDS USING X-RAYS AND NEUTRONS DIFFRACTION.

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The challenges of weight reduction in aerospace industry have drawn considerable interest in magnesium alloys technologies. Assessing the efficiency of new joining techniques, as Friction Stir Welding is then required. During Friction Stir Welding, the welding tool motion induces frictional heating and severe plastic deformation. Then, in addition to the microstructure and texture evolutions generally observed, significant residual stresses can result from this process.

The Friction Stir Welds have been processed using 2 mm thick hot rolled plates of AZ31 Magnesium alloy. Residual stress analysis was carried out on a Friction Stir Weld processed using optimum welding parameters. Laboratory X-Rays diffraction and Neutrons diffraction were performed. Indeed, the use of Neutrons diffraction was especially interesting because it avoids matter removal required with X-Rays technique. Moreover, with Friction Stir Welding, the complex thermo-mechanical input induces complex stress gradients. Then, the high penetration capability of the Neutrons diffraction technique was thus essential to allow the determination of stress gradients in a non-destructive way. Hahn Meitner Institüt (HMI, Berlin, Germany) E3 instrument and Institut Laüe Langevin (ILL, Grenoble France) SALSA instrument were used. $Sin^2\psi$ method was used to determine residual stresses obtained with X-Rays diffraction and HMI Neutrons diffraction, whereas the triaxial method was used to determine residual stresses obtained with ILL Neutrons diffraction.

The aim of this study is to investigate the residual stress distribution in Magnesium Friction Stir Welds and to compare the results obtained using several techniques.