FRICTION STIR PROCESSING OF ALUMINUM FUSION WELDS

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SUMMARY

Friction stir processing (FSP) was performed on fusion welded 6061-T651 and 5083-H321 Al alloys (6 mm thick). Three different FSP approaches were utilized in this presentation: fusion weld toe FSP, fusion weld crown FSP, and a combination of fusion weld crown and root FSP. The microstructures were described as a function of material region; i.e. course grain fusion weld, parent material, and fine grain FSP. Microstructural characterization was performed by light microscopy and scanning electron microscopy. The microscopic techniques detected the presence of three precipitate phases, which are most likely $Al_6(Fe,Mn)$, Mg_2Si, and $Al_5(Fe,Si)$. Surface residual stresses of the as-fusion welded and FSP of the fusion weld crown were compared. Within the region of the fusion weld, FSP modification was found to increase the tensile parallel residual stresses and increase the perpendicular residual stresses when compared to the as-fusion welded material. The addition of FSP was found to have no influence on the tensile properties of Al fusion welds. The high-cycle fatigue resistance increases with the addition of FSP to fusion welded 5083 (as compared to the as-fusion welded alloy). Fatigue properties were the same for both of the FSP approaches, indicating the FSP presence is important, not the FSP approach.