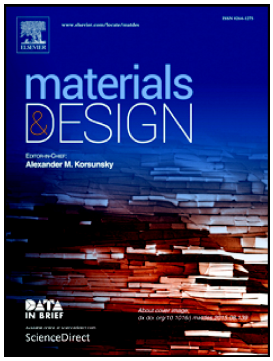

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In-situ grain structure and texture evolution during friction stir welding of austenite stainless steel

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Abstract

The in-situ grain structure and texture evolution during the whole process of friction stir welding (FSW) are clarified. As the base material approached the probe, grains were compressed, forming compression zone (CPZ). The grains evolved to fine equiaxed grains mainly through discontinue dynamic recrystallization (DDRX) and twining as it approached the tool. As material in MFZ rotated around the probe, the fraction of low-angle grain boundaries (LAGBs) was reduced, the ratio of twin boundaries increased, and the grain size distribution became wider, while the average grain size was fairly constant despite the increase in strain. After the material was deposited behind the probe, the grains began to grow. Deformation caused by tool shoulder disrupted the twin boundaries and generated some segments of LAGBs. In the post-weld zone, some LAGBs disappeared and new twin boundaries developed as a result of elevated temperatures. The B component {112}<110> was developed and was sustained in the MFZ with its shear direction being consisted with the local probe rotation. The shear plan of B component maintained approximately 30 deg away from the probe profile. In the weld zone behind the probe, the B component was weakened and evolved to a C component {001}<110>.

Keywords: texture; recrystallization; in-situ; friction stir welding; friction stir processing; electron backscattering diffraction (EBSD)

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