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Analysis of plastic anisotropy of Zircolay-4 combining in-situ and ex-situ techniques

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Analysis of the plastic anisotropy of rolled Zircolay- 4 during compressive loading in three orthogonal directions was performed using acoustic emission (AE) and scanning electron microscopy (SEM) techniques. The activity of the individual deformation mechanisms was monitored in-situ using AE and the microstructure was characterized in addition to the initial state after straining up to 2% and 12%, respectively, using electron backscatter diffraction (EBSD). The grain reference orientation deviation axis and angle maps were estimated from the EBSD data to reveal the evolution of slip system activities in individual grains. During compressive loading along the rolling (RD) and transverse (TD) directions, dislocation glide and twinning are the dominant deformation mechanisms. The AE technique reveals that a higher twin volume fraction in RD is more related to twin thickening than twin nucleation. With respect to the initial texture, the twinning is almost suppressed in loading along the normal direction (ND), and a contribution of several active slip systems to plastic deformation was analysed.

Keywords: zircaloy-4; texture; deformation mechanisms; acoustic emission; grain misorientation analysis

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