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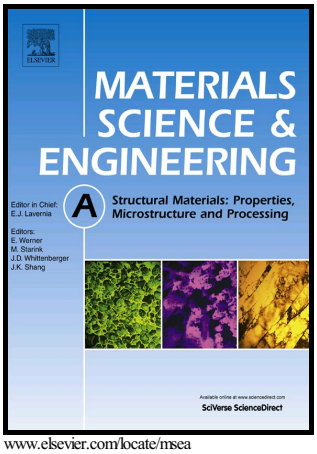

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Study of structure and residual stresses in cold rotary swaged tungsten heavy alloy

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Abstract

Cold processing of tungsten heavy alloys is a challenge, however masterable owing to the continuing development in forming technologies. This study deals with a thorough investigation of a WNiCo alloy rotary swaged at room temperature. Due to the low processing temperature, special focus is on residual stress evaluation, which was performed by means of neutron diffraction and scanning electron microscopy and supplemented with numerically predicted stress distributions. (Sub)structure of the swaged-piece was analysed via scanning and transmission electron microscopy and the whole study was completed with tensile tests results. The results showed a substructure featuring dislocation cells and subgrains supporting the observed work hardening. For the swaged-piece, the ultimate tensile strength exceeded 1 800 MPa. Analyses of grains misorientations indicated the presence of residual stresses especially on the swaged-piece periphery. This result was confirmed by the other performed analyses, all showing predominantly compression residual stresses within the swaged-piece, locally exceeding – 1500 MPa.

Keywords:

tungsten heavy alloy; residual stresses; neutron scattering; electron microscopy; work hardening