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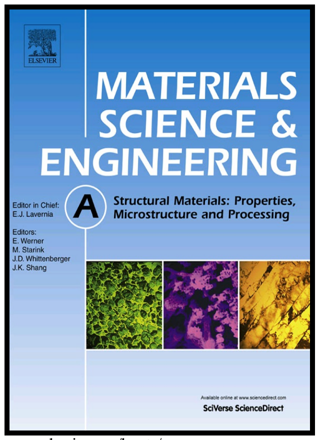

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PII: S0921-5093(18)30686-5
DOI: https://doi.org/10.1016/j.msea.2018.05.038
Reference: MSA36476

To appear in: *Materials Science & Engineering A*

Received date: 23 February 2018
Revised date: 4 May 2018
Accepted date: 10 May 2018

Cite this article as: Ludovic Cauvin, Balaji Raghavan, Salima Bouvier, Xiaodong Wang and Fodil Meraghni, Multi-scale investigation of highly anisotropic Zinc alloys using crystal plasticity and inverse analysis, *Materials Science & Engineering A,* https://doi.org/10.1016/j.msea.2018.05.038

Multi-scale investigation of highly anisotropic Zinc alloys using crystal plasticity and inverse analysis

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Abstract

Zinc and its alloys are important industrial materials due to their high corrosion resistance, low cost and good ductility. However, the characterization of these materials remains a difficult task due to their highly anisotropic behavior, the latter being due to the influence of microstructural effects, i.e. loading orientation-dependent activation of different families of slip systems and subsequent texture evolution, rendering the development of a reliable material model considerably difficult. A micro-mechanical approach based on polycrystal plasticity would better describe the physical mechanisms underlying the macroscopic behavior. This improved model should ostensibly improve the comprehension of the mechanical behavior, compared to the macroscopic approach using solely phenomenological anisotropy models along with a prohibitively large number of experiments required to identify the material parameters. In this paper, a multi-scale Visco-Plastic Self-Consistent (VPSC) approach is used. It is based on a micro-scale model calibrated by microstructural and deformation mechanism information based on Electron Back-Scattered Diffraction (EBSD) to describe the macroscopic anisotropic mechanical response during sheet metal deformation. The critical resolved shear stress (CRSS) as well as the micro-scale crystal parameters are obtained by an inverse analysis comparing the simulated and

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