Title: Study of novel magnesium alloys with controlled microstructure and texture

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Abstract:

The work elucidates the role of dislocation slip and twinning during plastic deformation in selected magnesium (Mg) alloys with controlled microstructure and texture. The acoustic emission (AE) technique was concurrently applied during deformation to determine the activity of particular deformation mechanisms. A detailed insight into microstructure was provided by electron microscopy.

In order to obtain a comprehensive set of AE data for particular deformation mechanisms, Mg single crystals with various crystallographic orientations were channel-die and uniaxially compressed. The obtained results were applied on deformation mechanisms in polycrystalline textured Mg alloys. Particularly, the twinning - detwinning processes, in the sense of twin boundary mobility, during one cycle loading (pre-compression followed by tension) were described. Clear correlations between changes in the AE response and the inflection points on the deformation curve were found. An analysis of twin activity with respect to different types of microstructure (bimodal or homogeneous) showed a grain size effect on twin nucleation. The influence of texture on the deformation behavior was also identified for conventionally rolled slabs and rolled twin-roll cast Mg alloy strips in the form of sheets. An anisotropy of mechanical properties may be easily associated with the texture asymmetry around the normal direction, which is formed during the particular rolling process.

Keywords: wrought Mg alloys, texture, deformation mechanisms, acoustic emission, mechanical properties.