Rate and Orientation Dependence of Formability in Fine-Grained AZ31B-O Mg Alloy Thin Sheet

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Abstract

Uniaxial tension and press forming tests were carried out under two different strain rates and temperatures to investigate the formability of fine-grained AZ31B-O Mg alloy thin sheet. Formability parameters were determined by tensile test results. The tensile properties and formability parameters were correlated with the forming limit diagrams. This work focused on the effects of loading orientation and deformation rate on the formability. Anisotropic behaviors were found in the mechanical properties. Maximum strengths were observed in the direction perpendicular to the rolling direction. The investigations led to the conclusion that the formability of the rolled fine-grained AZ31B-O Mg alloy sheet would be influenced by loading orientation and deformation rate. Stretch formability could be enhanced at a higher deformation rate resulting from a lower anisotropy and a higher work hardening effect; in contrast, the drawing processes should be performed at a lower deformation rate to take advantage of a higher anisotropic behavior. Specimens with the rolling direction parallel to the major strain in the press forming tests could enhance stretch formability, while specimens with the rolling direction perpendicular to the major strain could improve deep-drawability.
Keywords: anisotropy, fine-grained AZ31B-O Mg alloy, formability parameter, forming limit diagram.

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