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Role of one direction strong texture in stretch formability for ZK60 magnesium alloy sheet

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Abstract:

Three ZK60 resulting sheets with same grain size but various texture states were successfully fabricated by a combination process of hot rolling, cold rolling and annealing treatment. Subsequently, standard Erichsen tests were performed on these resulting sheets which possessed orthotropic basal texture exhibiting an egg-shaped asymmetric distribution of basal poles from the normal direction. Combining with the analysis of strain hardening ability obtained from uniaxial tension test, it could be concluded that the magnesium alloy sheets with orthotropic basal texture presented anisotropy in strain hardening ability, and their stretch formability was dependent on the strong texture in one direction of magnesium alloy sheets. That was to say, texture weakened only in single direction could not improve the stretch formability. This conclusion was supported more by the direction of crack propagation which was parallel to the weak texture direction of magnesium alloy sheet.

Keywords: ZK60; Stretch formability; Texture; Crack

1 Introduction

Due to the high specific strength and low density, magnesium alloys are the lightest structural metal, and their application is expanding, especially in aerospace and automotive industries [1]. However, their inherent hexagonal close packed (HCP) structures usually produce strong basal texture because their critical resolved shear stress (CRSS) of basal slip is much lower than non-basal slip. This leads to their poor sheet formability under the room temperature, which greatly limits their widespread commercial usability [2, 3].

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