

Tensile properties and shallow pan rapid gas blow forming of commercial fine-grained Mg alloy AZ31B thin sheet

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Abstract

Tensile tests and gas blow forming were performed to explore the deformation behavior of a fine-grained AZ31B Mg alloy sheet. This work studied the decrease in forming time in gas blow forming using fine-grained Mg alloy AZ31B thin sheet with a thickness of 0.6 mm. The stress-strain rate data showed that fine-grained AZ31B thin sheet on testing at 420 °C exhibited strain rate sensitivity exponent values of approximately 0.290.36 in a strain rate ranging from 4×10^3 and 2×10^2 s⁻¹, indicating that the dislocation creep would be a possible deformation mechanism to reduce forming time in gas blow forming. The alloy sheets were successfully deformed into a shallow rectangular pan using constant gas pressure forming. The deformation characteristics of gas blow forming were discussed. As a result, a significant reduction in forming time was achieved, in which a rectangular pan was formed with a height of 10 mm in less than 105 s at 420 °C. Pan forming revealed that the maximum average strain rates of 7.0×10^3 and 8.7×10^3 s⁻¹ were obtained for forming at constant pressures of 2.6 and 3.2 MPa, respectively. Fillet radius of the rectangular pan should be one of the key factors influencing forming time on closed die gas blow forming.

Keyword : Rapid gas blow forming, of commercial, Fine-grained Mg alloy, AZ31B