Deformation characteristics of fine-grained magnesium alloy AZ31B thin sheet during rapid gas blow forming

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Abstract

Decreasing the forming time in gas blow forming using fine-grained Mg alloy AZ31B thin sheet with a thickness of 0.6 mm was studied in this work. Tensile tests and gas blow forming using stepwise pressurization profiles were performed to explore the deformation behavior of a fine-grained AZ31B Mg alloy sheet. The alloy sheets were successfully deformed into hemispherical domes using two proposed stepwise pressurization profiles during gas blow forming. As a result, significant reduction in forming time was achieved. Maximum effective deformation rates of 1.02102 and 1.98102 s1 were obtained at temperatures of 300 and 370 C, respectively. It was feasible to form a hemispherical dome with a height of 20 mm in less than 80 s at 370 C. The results confirmed that the thickness distribution along the centerline of the formed dome was sensitive to the pressurization profiles. A higher thinning effect was observed at 370 C due to the higher deformation rate imposed during forming. Grain growth was not a serious problem for forming even at a temperature of 370 C, and static grain growth should be the major factor resulting in grain growth during forming.

Keyword：AZ31B Mg alloy; Strain-rate sensitivity; Gas blow forming; Pressurization profile.