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Hot forging of high-aluminum content magnesium alloys by using a servo press

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This paper deals with an innovative hot-forging process of high-tensile-strength magnesium alloy material that contains relatively high aluminum content. By applying a servo press machine, a novel hot-forging process was performed with development of high-strength magnesium alloys. Firstly, friction properties and isothermal deformation resistance during hot forming (350°C and 400°C) of Mg-Al-Ca-Mn series magnesium alloy (AXM4303 alloy) were investigated by ring-compression tests. In ring-compression tests, friction coefficients between dies and magnesium alloys are obtained using graphite, PTFE, and an oil lubricant. A novel lubricant that could prevent sticking between dies and materials was developed by hot-forging experiments. Secondly, high-tensile-strength magnesium alloys containing 9 to 12% aluminum, such as AZ91, AZ101, AZ111, and AZ121 have been made by twin-roll casting. A new experiment was performed for hot-forging of high-strength magnesium alloys with high aluminum content. From the results, it was understood that using magnesium alloys with high aluminum content yielded less compressive deformation resistance than AXM403. It was also demonstrated that hot-forging of magnesium alloys with high aluminum content produces small magnesium crystals (about 6 micrometers) and crystallized substances. The effects of the dynamic recrystallization on the microstructures of the products formed at two different temperatures (300°C and 350°C) seem to differ. Forging at 350°C improved mechanical properties and yielded the best formability.

Biography

Hisaki Watari has received his PhD in Mechanical System Engineering, from Gunma University, Japan in 2006. He has been researching into properties of magnesium alloy by rapid cooling by using twin roll casting in these fifteen years in Gunma University and Oyama National College of Technology in Japan, in UMIST in the UK. He is now Head of Association of Aluminum Forging Technology in Japan. He has published more than 130 papers in journals and is conducting works related to metal forming of light metals, such as aluminum and magnesium alloys.

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