

FE analysis on tube hydroforming of small diameter ZM21 magnesium alloy tube

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ABSTRACT

Tube hydroforming (THF) is one of the plastic processing methods. The tubular parts are expanded by loaded internal pressure and axial compression force to deform a target shape. Loaded pressure and fore form the complex cross-section shape parts integrally; these products achieve weight reduction and high strength. It has been widely used in the automobile and aircraft industries. In addition, THF has less restriction on shape and size of workpieces in order to adopt the liquid tool. It is expected that manufacture small diameter tubular parts by THF. To apply these parts for miniaturized electronic devices and medical devices is researched [1]. Moreover, magnesium and its alloys are promising metal as a material of the medical equipment parts [2]. Magnesium has excellent characteristics that harmless element for the human because of necessary for health of body as well as low densities and excellent strength. To manufacture small diameter magnesium alloy tubular parts by THF has been promised. However, deforming of magnesium alloy is hard due to relatively low formability at room temperature [3]. Also, it is difficult to predict the deformation behaviour owing to size effect [4]. Accordingly, it is necessary to improve of formability and clarify the deformation characteristics of the small diameter magnesium alloy tube in THF. In this study, it is investigated that influence of processing temperature, internal pressure and axial feed amount on formability of small diameter ZM21 magnesium alloy tube with outer diameter of 2.0mm and thickness of 0.20mm. As the result, it was elucidated that effect of the processing temperature, the variable internal pressure and the axial feeding amount on deformation behaviour by FE analysis. Stress state in the deforming was revealed. Furthermore, the processing conditions for improve the formability of material in warm THF was examined.

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