

EFFECT OF TEMPERATURE, STRAIN RATE AND COEFFICIENT OF FRICTION ON DEEP DRAWING PROCESS OF 6061 ALUMINUM ALLOY

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ABSTRACT

Deep drawing is an essential process used for producing cups from sheet metal in large quantities. So, understanding the mechanics of the cup drawing process helps in determining the general parameters that affect the deep drawing process. There are generally two methods of analysis: experimental and numerical. Experimental analysis can be useful in analyzing the process to determine the process variables that produce a defect free product. However, experimental work is usually very expensive and time consuming to perform. On the other hand, the numerical modeling can be used to model and analyze the process through all stages of deformation. This paper deals with the analysis of deep drawing of circular blanks into axi-symmetric cylindrical cups forming using finite element analysis. The present work emphasizes the formability of cylindrical cups using high temperature-high strain rate (HTHSR) super plastic forming process. A statistical approach based on Taguchi Techniques and finite element analysis were adopted to determine the formability of 6061 Al alloy cups. The process parameters were temperature, strain rate, coefficient of friction and blank holder velocity. The FEA results obtained using finite element software namely D-FORM were validated through the experimental results. For 6061 Al alloy, the HTHSR super plastic forming process has happened at strain rate 0.1 s^{-1} and temperature of 300°C .

KEYWORDS: 6061 Al Alloy, High Temperature, High Strain Rate, Super Plastic Deep Drawing Process, Coefficient of Friction, Cylindrical Cups, Forming Limit Diagram