Finite Element Analysis of Counterbore-shaped Parts by Using Sheet-bulk Metal Forming Process

Sutasn Thipprakmas[1], Arkarapon Sontamino[2], and Wiriyakorn Phanitwong[1]
[1]Department of Tool and Materials Engineering, King Mongkut's University of Technology Thonburi, Thailand, E-mail: sutasn.thi@kmutt.ac.th, wiriyakorn.wp@gmail.com
[2]Graduate student, Dept. of Tool and Materials Engineering, King Mongkut's University of Technology Thonburi, Bangkok, Thailand

The merits of metal-forming process, as compared to the material removal process, are a good utilization of material and shorten the production time. To fabricate the complex shaped parts, it is increasingly applied. As a particular type of metal-forming process, to produce counterbore-shaped parts, the sheet-bulk metal forming which controls the flow of material into special punch and die was investigated in the present study. The finite element method (FEM) was used as a tool to investigate the sheet-bulk metal forming mechanism and their defects occurred during process. The sheet-bulk metal forming mechanism and poor squareness defect were clearly identified via the changes of the material flow and stress distribution analyses. In addition, the relationships between forged punch diameter and limitation of material thickness and hole diameter changes after forging were also investigated. Laboratory pressing experiments were performed to validate the accuracy of the FEM simulation results. The FEM simulation results showed good agreement with the experimental results with regards to the dimensions of the cut surface in the punching operation and counterbore shape in the sheet-forging operation.

Keywords: Sheet-bulk metal forming; Sheet-forging; Punching; Counterbore; Finite Element Analysis

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