Title: Metal flow control during hot forming of square cups with local-thickened plates and varied friction conditions

Authors: Xinyun Wang, Jinbo Li, Lei Deng, Jianjun Li

PII: S0924-0136(17)30436-3
DOI: https://doi.org/10.1016/j.jmatprotec.2017.09.037
Reference: PROTEC 15414

To appear in: *Journal of Materials Processing Technology*

Received date: 2-5-2017
Revised date: 19-8-2017
Accepted date: 24-9-2017

Please cite this article as: Wang, Xinyun, Li, Jinbo, Deng, Lei, Li, Jianjun, Metal flow control during hot forming of square cups with local-thickened plates and varied friction conditions.Journal of Materials Processing Technology https://doi.org/10.1016/j.jmatprotec.2017.09.037

Metal flow control during hot forming of square cups with local-thickened plates and varied friction conditions

Xinyun Wang*, Jinbo Li, Lei Deng, Jianjun Li

State Key Laboratory of Materials Processing and Die & Mould Technology, Huazhong University of Science and Technology, 1037 Luoyu Road, Wuhan 430074, China

**Corresponding author: E-mail address: wangxy_hust@163.com; Tel.: +86-2787543491.*

Highlights

- Local-thickened plates and friction control were combined to form square cups with small corner radii
- A relationship model between flow dividing surface (FDS) and friction coefficients was established
- Increasing the blank/upper punch interfacial friction can effectively reduce the bottom corner radius

Abstract: Obtaining square cups with the radius at the bottom corner lower than the thickness of original plate via a single-step hot forming process is a challenge. In this paper, a processing way was proposed by combining local-thickened plate and friction control, to manufacture square cups with small corner radii. Through finite element (FE) simulations, the metal flow during hot forming of square cups was optimized by varying the shape of the local thickened section and adjusting the friction conditions at the interfaces between blank and tools. It was found that the filling ratio of the bottom corner can be significantly improved by increasing the friction coefficient at the interfaces between the blank and the upper punch, and that between the blank and the central zone of counter punch. The established flow dividing surface (FDS) model is capable for describing the variation of metal flow with the friction coefficients. Base on the simulation results, hot forming experiments were also carried out, and square cups with small radii of 2 mm at the bottom corners were successfully manufactured.