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Experimental Evaluation of The Size Effects on Material Behavior and Microscale Deformation Characteristics in Microforming Processes

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Key words : Microforming, Plastic Deformation, Size Effect, Metallic Materials, Micro Machine

1.

0.1 μ m

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1.5

가

가

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(rules of similarity)
fect)가

(size ef-

[1].

Vollertsen

[2-5].
가

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2.

Fig. 1

320 x 400

x 665 mm, AC
(ratio, 10:1),

(6,000 rpm),
(LM) 가

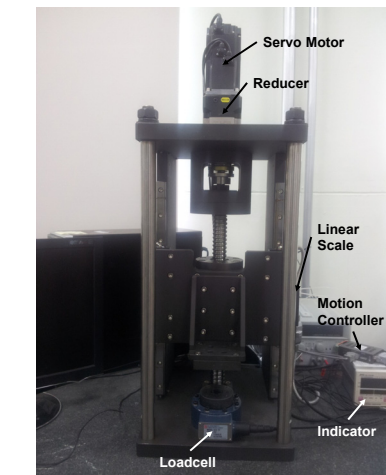


Fig. 1 Miniaturized microforming system

Fig. 2

5mm, 3.4mm, 8mm, 3mm

Table 1

가, 300, 500, 700, 가, 1

600MPa, 30 μ m/s,
100, 200, 300, 400 μ m 4가

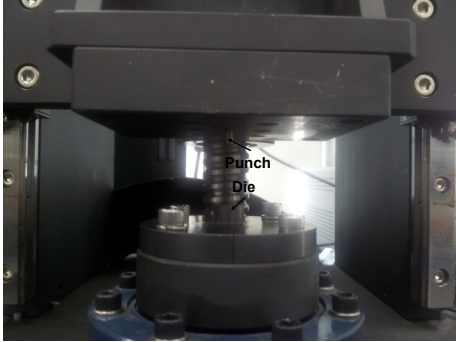


Fig. 2 Experimental tooling set

Table 1 Experimental and process conditions

Workpiece	Copper
Max. forming force	600 MPa
Punching velocity	30 μm/s
Micro channel	100, 200, 300, 400 μm
Annealing temperature	300, 500, 700 °C

3.

가 (100, 200, 300, 400 μm)

가 Fig. 3

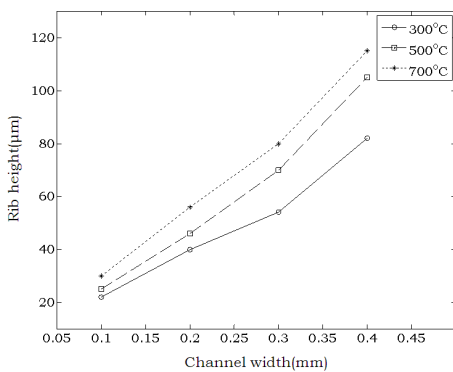


Fig. 3 Rib height variations at different channel widths and grain sizes

Fig. 3

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4.

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1. Geiger, M., Kleiner, M., Eckstein, R., Tiesler, N. Engel, U., "Microforming," 51st General Assembly of CIRP, Nancy, **50**, 445-462, 2001
2. C. Barbier, S. Thibaud. and P. Picart, "Size Effects on Material Behaviour in microforming," International Journal of Material Forming, 439-442, 2008.
3. T.A. Kals. and R. Eckstein, "Miniaturization in Sheet Metal Working," Journal of Material Processing Technology, **103**, 95-101, 2000.
4. H.S. Kim and Y.S. Lee, "Size Dependence of flow stress and plastic behaviour in microforming of polycrystalline metallic materials," Proc. IMechE Part C: J. Mechanical Engineering Science, **226**, 403-412, 2012.
5. F. Vollertsen., Z. Hu., H. S. Niegoff. and C. Theiler, "State of the Art in Micro Forming and Investigations into Micro Deep Drawing," Journal of Materials Processing Technology, **151**, 70-79, 2004.