Research topics for graduate students for 2023

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Acceptable course(s)

- Master's Degree
- Doctoral Degree

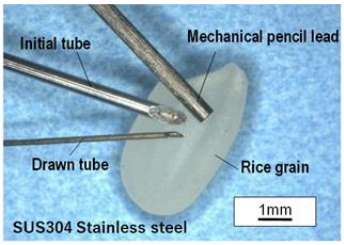
Research Topics

We are conducting research on deformation process on the theme of "material deformation" related to "manufacturing process". We cover both experimental and theoretical approaches such as stamping, tube forming, material modeling, dieless forming, micro metal forming by focusing on "permanent deformation of materials".

1. Material Modeling Considering Microstructure, Surface Roughness and Ductile Fracture

At the scale of micro precision stamping, the relative microstructure size and surface roughness for material size becomes large. The free surface roughening may affect origin of fracture and tribological behavior under contact condition with die and tool. In this study, we consider the material inhomogeneity into finite element simulation (FEM) for predicting free surface roughening and fracture in the micro precision stamping successfully [1].

2. Local Heated Dieless Forming without Using any Dies and Tools



In general metal forming process, we need dies and tools. However, the manufacturing dies and tools with high cost is not al in small quantities. Thus, a novel dieless forming process without using any dies and tools for metal forming is focused on. We fabricated various products for medical, life science, energy, mechanical such as micro tubes, magnesium alloy tube with thin wall for bioabsorbable stents, micro needles for live cell atlas, bellows and ceramics tubes.

Articles Related to Research Topics

[1] T. Furushima, T. Nakayama, K. Sasaki: A new theoretical model of material inhomogeneity for prediction of surface roughening in micro metal forming, CIRP Annals - Manufacturing Technology, Vol. 68, No. 1, (2019) pp. 257-260. (https://doi.org/10.1016/j.cirp.2019.04.057)

[2] P. Du, S. Furusawa, T. Furushima: Microstructure and performance of biodegradable magnesium alloy tubes fabricated by local-heating-assisted dieless drawing, Journal of Magnesium and Alloys, Journal of Magnesium and Alloys, Vol. 8, No. 3 (2020), pp. 614-623. (https://doi.org/10.1016/j.jma.2020.05.009)

[3] Y. Yi, K. Shinomiya, R. Kobayashi, H. Komine, S. Yoshihara, T. Furushima: A novel superplastic dieless drawing using fracture phenomenon for fabrication of metal tubular microneedles, CIRP Annals, Vol. 71, No. 1 (2022), pp. 237-240 (https://doi.org/10.1016/j.cirp.2022.03.037)

Lab. Web page: https://www.furulab.iis.u-tokyo.ac.jp/en/index.html