

## ABSTRACT

The aim of this research study is to investigate, experimentally, the feasibility of the micro-extrusion process for producing defect-free extruded micro parts using metals. The formability of the metallic materials in micro-scale is compromised due to factors such as size effect, strain rate effect and interfacial frictional effect. By analyzing the deformational material behavior at different grain size, the defect-free micro-parts could be produced.

Micro-extrusion is a well-developing manufacturing process in producing micro-parts with minimal material wastage. Research on several materials has been undergoing to study the material behavior and grain size during the plastic deformation process. The outcomes have very high potential in bulk manufacturing of micro-parts in electronics, bio-medical and medical industry.

In this work, the formability and size effect, strain rate effect, temperature effect and friction effect in AZ80 magnesium alloy, CZ108 brass alloy and 6063 aluminum alloy using micro-extrusion process has been investigated. The micro-extrusion process is conducted using the exclusively developed indigenous tooling system. For each material three different grain sizes are obtained for investigation and friction effect is studied with four different lubrication conditions. Also MgO-ZnO nano-additive blended lubricant is prepared and investigated in micro-extrusion process. Based on the experiments performed, the force-displacement curve for every material and process condition is extracted. The effects of process parameters are also investigated.

Experiment demonstrates the material deformational behavior at different process conditions. Every material has its own unique characteristics and properties to respond during the deformation process. Hence, the material

should be investigated to identify its deformational behavior before its mass production. The results obtained from this work will be useful for understanding the deformation behavior during the micro-extrusion process of micro-parts in mass production using micro-extrusion process.