ABSTRACT

Single Point Incremental Forming (SPIF) is steel sheet forming process in three-dimensional shapes. It is likely to be used for prototyping rapidly and minimum volume production of metal sheet parts. The recompenses of SPIF process is low cost tooling, less product lead time, and high flexibility. While abundant researches have been conceded out to fit the method for industrial function, still they still stumble upon insufficient forming qualities in the sheet metal products.

Since the major researches are mainly done only on the hemispherical tool. This research mainly focuses on the development of single point incremental forming process using roller ball tool at room temperature. A group of polymer materials with high industrial potential applications are opted for the single point incremental forming process. The application mainly encloses automobile components, medical components and electrical components. Previous researches were done on the conical shape, but square geometry has been attempted for the study.

In evaluating the early formability, the Erichsen cupping test is performed for all materials. Moreover, Forming Limit Diagram (FLD) for materials in single point incrementally forming is performed experimentally to identify the forming limit of individual materials.

The forming force, thickness distribution, and surface roughness are experimented by changing the process parameters such as tool diameter, sheet thickness, table feed and spindle speed. Design of Experiments (DOE) with the Taguchi method is used to design the number of experiments. To perform the experiments, polymer sheets namely Polycarbonate (PC), Polyvinylchloride (PVC), High Density polyethylene (HDPE) and Polypropylene (PP) are used.

The results obtained are deliberated with dissimilar process parameters and the belongings are identified as (i) Process formability (ii) Forming forces (iii) Microstructure analysis and (iv) Surface roughness. The work explores a number of aspects of single point incremental forming on polymers, although the most important contribution aims on optimization of process parameters and its validation. It improve the process formability and obtains maximum uniform thickness distribution of the formed parts. This gives an considerate into supplementary progress and the purpose of single point incremental forming technology in the production of polymer parts.