

Effect of process parameters on the surface roughness of aluminum alloy AA 6061-T6 sheets in frictional stir incremental forming

ABSTRACT

Incremental Sheet Forming (ISF) is characterized by essential flexibility, great formability, and low forming forces and cost compared to the conventional sheet metal forming processes. ISF was born as an advance sheet metal forming process to perfectly fit previous requirements. Nevertheless, growing demand to apply the lightweight materials in several fields was placed this developed process in a critical challenge to manufacture the materials with unsatisfied formability especially at room temperature. Thus, utilizing the heat at warm and hot condition in some ISF processes has been introduced to solve this problem. Among all heat-assisted ISF processes, frictional stir-assisted Single Point Incremental Forming (SPIF) was presented to deal with these materials. In this work, this emerging process was utilized to manufacturing products from AA6061-T6 aluminum alloy. Experimental tests were performed to study the influence of main parameters like tool rotation speed, feed rate, step size and tool size on the surface roughness of the produced parts. A Taguchi method and varying wall angle conical frustum (VWACF) test were used in the present work. The results find that tool diameter has a significant impact on the internal surface roughness produced via the forming process with a percentage contribution of 93.86 %. The minimum value of the surface roughness was 0.3 μm .

Keyword: Friction stir forming; Incremental sheet forming (ISF); Heat-assisted ISF; Surface roughness; Aluminum alloy (AA6061-T6)