PAN HEAD BOLT AND INSERT COMPONENT DIE WEAR ANALYSIS AND INVESTIGATION OF SURFACE FINISH OF ALUMINIUM 6061 COMPONENT USING BIO LUBRICANTS IN HOT FORGING

Abstract

One of the main critical problems in the hot forging process is the temperature rise in the die cavity and huge stresses generated during forging operation, which leads to die failure due to wear, deformation of a die, cracks etc. In this study, wear analysis was carried out in a pan head bolt die and an insert die in a local industry. The simulation of the forging process on the die and the work piece was carried out using commercially available software (DEFORM). The flow of the material in the die, die filling, contact pressure distribution, sliding velocities and temperature distribution of the die have been investigated. The depth of wear in the die cavity was evaluated using the Finite Element simulation and then the total wear depth was determined. By comparing the numerical results with the measurement taken from the worn die, the wear coefficients were evaluated at different locations of the die cavity and finally an average value of wear coefficient is suggested.

In addition, the effect of using different lubricants, on the surface finish of aluminium alloy component was carried. For a given aluminium alloy forging, the pressure requirements in forging vary widely and it depends primarily on the chemical composition of the alloy being forged, the forging process employed, the forging strain rate, the lubrication, and the work piece and the die temperature.

Surface roughness in a forged aluminium component depends on properties like lubrication and temperature. In this research work, the surface roughness measurement was carried on aluminium contact base component made by hot forging. The most common lubricants applied in hot forging of aluminium are oil-based and water-based graphite lubricants. Oil based graphite lubricants give certain health and safety challenges and a not eco-friendly. Water-based graphite lubricants do not give optimal lubrication at high temperatures. Therefore, alternate lubricants such as bio-oils were used and its performance were tested based on the Taguchi‟s design of experiments. The results obtained are discussed and it is found that of the five types bio-oils used in the experiment namely (Vitis vinifera, Annona squamosa, Jatropha, Olive and Coconut oils),Vitis vinifera bio-oil has given a better performance.