

A study on properties of polymer-based additive manufacturing

ABSTRACT

In recent years, increasing interest in 3D Printing (3DP) has meant that printer usage is not limited to industrial purposes only, but is also for domestic usage by hobbyists for their individual needs. Polymer-based part production can now even be conducted outside the traditional factory environment. However, low grade printers pose some drawbacks, such as lower heat for material fusion, uncontrolled open ambience and limited nozzle size. These reduce the mechanical and aesthetical qualities as compared to parts fabricated using industrial grade printers. The study aims to perform some quality comparisons between 3D printed polymeric parts fabricated by both industrial and low cost printers, and subsequently to prove the hypothesis that the industrial grade printed part has a more reliable surface quality and mechanical properties. Specimens were fabricated using each printer type (Fused Deposition Modelling (FDM) represents the low cost printer and the Multi Jet Printer (MJP) is used for the industrial grade) and later tested for hardness and surface roughness. Comparisons were then made between different fabricating methods and also based on a literature study according to the type of materials. The experiments showed that both the surface roughness and hardness for the plastic parts fabricated by the industrial grade printer were better than those made by the domestic printer, and showed a good agreement with the results in the literature study. Therefore, for highly durable parts, it is suggested that industrial grade printers are used. One point to conclude the study, Rapid Prototyping is possible by any machine, but for Rapid Manufacturing that requires higher durability, it is better to use an industrial grade printer.

Keyword: Additive manufacturing; 3D printing; Rapid prototyping; Polymer