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Hardness Properties of 3D Printed PLA Parts by Fused Deposition Modeling Process

Authors : Anis A. Ansari, M. Kamil

Abstract : The development of 3D printing technology has allowed the manufacturing industry to create parts with a high degree of automation, increased design freedom, and improved mechanical performance. Fused deposition modelling (FDM) is a 3D printing technique in which successive layers of thermoplastic polymer are deposited and controlled to create a three-dimensional product. In this study, process parameters such as nozzle temperature and printing speed were chosen to investigate their effects on hardness properties. 3D printed specimens were fabricated by an FDM 3D printer from Polylactic acid (PLA) polymer. After analysis, it was observed that the hardness property is much influenced by print speed and nozzle temperature parameters. Maximum hardness was achieved at higher print speed which indicates that the Shore D hardness is directly proportional to the print speed. Moreover, at higher print speed, it has no significant dependence on the nozzle temperature. Hardness is also influenced by nozzle temperature, though to a lesser extent. The hardness slightly lowers when the nozzle temperature is raised from 190 to 210 oC, but due to improved bonding between each raster, a further rise in temperature increases the hardness property.

Keywords : 3D printing, fused deposition modeling (FDM), polylactic acid (PLA), print speed, nozzle temperature, hardness property
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