Polishing of fused deposition modeling products by hot air jet: Evaluation of surface roughness

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Abstract:

In this study, a novel low-cost polishing process is applied on the surface of Fused Deposition Modeling (FDM) products. The developed polishing technique impinges a jet of hot air exit from a nozzle to FDM surfaces. The hot air locally melts the staircase on the surface and leaves it smoother by the effect of sintering phenomenon. Accordingly, the process introduces three main parameters: air jet temperature; air jet velocity; and nozzle translational velocity over the part surface. An experimental test rig was constructed to evaluate the polishing process and its parameters using surfaces with average pre-processed Ra values of 7.5 ± 0.5 μm. The process shows significant and reproducible improvements in surface roughness inherent with a glossy surface; whereas, an average reduction ratio up to 88% was reached which corresponds to Ra of 0.85 μm. It was found that there is an allowable range of nozzle translational velocity for every combination between jet velocity and jet temperature; otherwise, lower nozzle velocity than allowable causes overheating and surface deterioration. Furthermore, the study presents in-depth investigation to these deterioration phenomena appeared on the surface. As a result, this investigation demonstrated the possible defects in FDM part surfaces and also evaluated different process parameters. Moreover, it was observed that surface defects are reduced in the polished surfaces. For a concise conclusion, it was found that the condition of low jet velocity and high jet temperature gives the best polishing result over the allowable nozzle velocities.

Keywords:

Fused deposition modeling Polishing Hot air Surface roughness Surface defects Sintering

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