2nd International Conference on Polymer Processing and Characterization (ICPPC-2010),January 15-17, 2010, Mahatma Gandhi University, Kottayam, India.

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Improving the Surface Finish of ABS Plastic Parts built through Fused Deposition Modelling (FDM) process

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Rapid prototyping (RP) can be defined as a group of techniques used to fabricate a part or assembly using three dimensional (3D) computer aided design (CAD) data by stacking and bonding two and a half dimensional (21/2D) layers in a given direction. With the advent of first RP machine in mid 80's, it has gained attention of manufacturing industries due to advantages like freeform fabrication, no tooling requirement and fast and simple operations. Irrespective of these advantages, the resulting parts have weak mechanical strength, poor dimensional accuracy and surface finish. However, methods have been proposed to improve dimensional accuracy and mechanical strength [3, 4] simply through controlling of process related variables. In addition to strength and dimensional integrity, a good surface finish is also an important characteristic for functional requirement of RP parts.

Present work highlights on modelling aspects of fused deposition modelling (FDM) process for surface finish improvement. A face centred centre composite design (FCCCD) is employed not only to reduce experimental runs but also develop empirical relations among responses and process variables. Roughness is measured on the top, side and bottom face of test part. Predictive equations were derived using full quadratic model and response surface plot is used for factor analysis. To determine the optimum factor level settings for minimization of roughness on each face in a single setting, principal component analysis is used for combining all the responses into a single response. Finally, this single response is optimized using a latest evolutionary technique known as bacteria foraging optimization algorithm (BFOA).

[1] Sood, A.K., Ohdar, R.K., and Mahapatra, S.S., "Improving dimensional accuracy of fused deposition modelling process using grey Taguchi method", Materials and Design, (2009), 30(10), 4243-4252

[2] Sood, A.K., Ohdar, R.K., and Mahapatra, S.S., "Parametric appraisal of mechanical property of fused deposition modelling processed parts", Materials and Design (2009), doi:10.1016/j.matdes.2009.06.016.

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