Effect of process parameters on flow length and flash formation in injection moulding of high aspect ratio polymeric micro features

This paper reports an investigation of the effects of process parameters on the quality characteristics of polymeric parts produced by micro injection moulding (µIM) with two different materials. Four injection moulding process parameters (injection velocity, holding pressure, melt temperature and mould temperature) were investigated using Polypropylene (PP) and Acrylonitrile Butadiene Styrene (ABS). Three key characteristics of the mouldings were evaluated with respect to process settings and the material employed: part mass, flow length and flash formation. The experimentation employs a test part with four micro fingers with different aspect ratios (from 21 up to 150) and was carried out according to the Design of Experiments (DOE) statistical technique. The results show that holding pressure and injection velocity are the most influential parameters on part mass with a direct effect for both materials. Both parameters have a similar effect on flow length for both PP and ABS at all aspect ratios and have higher effects as the feature thickness decreased below 300 µm. The study shows that for the investigated materials the injection speed and packing pressure were the most influential parameters for increasing the amount of flash formation, with relative effects consistent for both materials. Higher melt and mould temperatures settings were less influential parameters for increasing the flash amount when moulding with both materials. Of the two investigated materials, PP was the one exhibiting more flash formation as compared with ABS, when corresponding injection moulding parameters settings for both materials were considered.
Laser confocal microscope noise evaluation on injection compression moulded (ICM) transparent polymer Fresnel lenses

The evaluation of an adequate and robust measuring strategy, for roughness assessment of polymer Fresnel lenses is put under assessment. An ‘on-sample’ measurement noise, is evaluated using a laser confocal microscope (OLYMPUS © Lext). Secondly, the lowest-noise roughness measuring procedure, on an injection compression moulded (ICM) Fresnel lens, is defined. A set of two different objectives is considered, i.e. a standard series (SO), against a long working distance one (LWD); two different magnifications objectives, 50x and 100x and the use or not of a dark environment. The noise evaluation is performed by comparing ‘on-sample’ noise with the one calculated on an optical flat. Noise is investigated by means of established methods, i.e. subtraction and averaging methods. Afterwards, the lowest-noise analysis is structured following a 23 full factorial experimental planning, whose factors are measuring working distance, objective magnification and room lighting. The result confirms a strong difference of noise, using the considered objectives. The most interesting result is that the performance of SO 50x objective is better than LWD 100x.

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