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Research Article

Experimental and Theoretical Investigations of Mouldability for Feedstocks Used in Powder Injection Moulding

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Abstract

Experimental and theoretical analyses of mouldability for feedstocks used in powder injection moulding are performed. This study covers two main analyses. (i) *The experimental analysis*: the barrel temperature, injection pressure, and flow rate are factors for powder injection moulding (PIM). Powder-binder mixture used as feedstock in PIM requires a little more attention and sensitivity. Obtaining the balance among pressure, temperature, and especially flow rate is the most important aspect of undesirable conclusions such as powder binder separation, sink marks, and cracks in moulded party structure. In this study, available feedstocks used in PIM were injected in three different cavities which consist of zigzag form, constant cross-section, and stair form (in five different thicknesses) and their mouldability is measured. Because of the difference between material and binder, measured lengths were different. These were measured as 533 mm, 268 mm, 211 mm, and 150 mm in advanced materials trade marks Fe – 2Ni, BASF firm Catamould A0-F, FN02, and 316L stainless steel, respectively. (ii) *The theoretical analysis*: the use of artificial neural network (ANN) has been proposed to determine the mouldability for feedstocks used in powder injection moulding using results of experimental analysis. The back propagation learning algorithm with two different variants and logistic sigmoid transfer function were used in the network. In order to train the neural network, limited experimental measurements were used as training and test data. The best fitting training data set was obtained with three and four neurons in the hidden layer, which made it possible to predict yield length with accuracy at least as good as that of the experimental error, over the whole experimental range. After training, it was found that the R2 values are 0.999463, 0.999445, 0.999574, and 0.999593 for Fe – 2Ni, BASF firm Catamould A0-F, FN02, and 316L stainless steel, respectively. Similarly, these values for testing data are 0.999129, 0.999666, 0.998612, and 0.997512, respectively. As seen from the results of mathematical modeling, the calculated yield lengths are obviously within acceptable uncertainties.