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Effect of Tool Size and Cavity Depth on Response Characteristics during Electric Discharge Machining on Superalloy Metal - An Experimental Investigation

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Abstract : Electrical discharge machining, also known as EDM, process is one of the most applicable machining process for removal of material in hard to machine materials like superalloy metals. EDM process utilizes electrical energy into sparks to erode the metals in presence of dielectric medium. In the present investigation, superalloy, Inconel 718 has been selected as workpiece and electrolytic copper as tool electrode. Attempt has been made to understand the effect of size of tool with varying cavity depth during drilling of hole through EDM process. In order to systematic investigate, tool size in terms of tool diameter and cavity depth along with other important electrical parameters namely, peak current, pulse-on time and servo voltage have been varied at three different values and the experiments has been designed using fractional factorial (Taguchi) method. Each experiment has been repeated twice under the same condition in order to understand the variability within the experiments. The effect of variations in parameters has been evaluated in terms of material removal rate, tool wear rate and surface roughness. Results revel that change in tool diameter during machining affects the response characteristics significantly. Larger tool diameter yielded 13% more material removal rate than smaller tool diameter. Analysis of the effect of variation in cavity depth is notable. There is no significant effect of cavity depth on material removal rate, tool wear rate and surface quality. This indicates that number of experiments can be performed to analyze other parameters effect even at smaller depth of cavity which can reduce the cost and time of experiments. Further, statistical analysis has been carried out to identify the interaction effect between parameters.

Keywords : EDM, Inconel 718, material removal rate, roughness, tool wear, tool size
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