中文摘要

放電加工常會導致加工表面粗糙與產生變質層，對工件造成不良影響，故往往需要藉由後續處理去除。本論文針對 SKD11 工具鋼微孔放電加工後表面粗糙度、擴孔量與變質層厚度等表面特性進行研究。

本論文實驗主要分爲兩個部份，首先利用田口式 L9 直交表做實驗分析，得到影響材料移除率、電極消耗比、表面粗糙度、擴孔量與變質層厚度的主要影響加工參數及最佳參數組合；接著藉由田口方法所得之主要影響參數，進行全因素實驗及迴歸分析，以了解放電加工參數對材料移除率、表面粗糙度、擴孔量與變質層厚度的影響趨勢及關聯性。

由田口變異數分析得知，影響材料移除率的主要影響參數爲放電脈波週率，次要爲放電電流；電極消耗比的主要影響參數爲放電脈波週率，次要爲放電電流；表面粗糙度的主要影響參數爲放電電流，次要爲放電脈波週率；擴孔量的主要影響參數爲放電脈波週率，次要爲放電電流；變質層厚度的主要影響參數爲放電脈波週率，次要爲放電電流。而由全因素實驗可知：材料移除率、表面粗糙度、擴孔量與變質層厚度會隨著放電電流與放電脈波週率的增加而增加。並由迴歸分析可得到材料移除率的經驗公式爲：MRR=0.000008(Ip0.81×Ton1.2)；表面粗糙度的經驗公式爲：SR=0.0813(Ip0.59×Ton0.36)；擴孔量的經驗公式爲：HE=0.0045(Ip0.7×Ton0.3)；變質層厚度的經驗公式爲：WLT=8.95(Ip0.05×Ton0.2)。

英文摘要

Electrical-discharge machining offen tends to induce roughness and the transformation layer on the machined surface, and induces negative effects to tool steel dies. Subsequent operations are required to clear them off. The study with the purpose of tool steel grade SKD11 to be experimented on the micro-hole electrical-discharge machining to analyze the surface roughness, hole enlargement and the transformation layer resulting from EDM process.

The experiment consists of two steps in this paper. The first step is to use Taguchi method L9 orthogonal array to obtain those primary EDM parameters affecting the material removal rate, the relative electrode wear ratio, the surface roughness, the hole enlargement and the thickness of the transformation layer, and to get the optimal parameters group. The next step is to conduct full factorial experiments and regression analysis with the primary effective parameters to understand the trend of the effect and relation between the parameters and the material removal rate, the surface roughness, the hole enlargement, and the thickness of the transformation layer. By the deviation analysis of Taguchi method, we find pulse-on duration are the primary influencing parameters for the material removal rate, the secondary parameters is the pulse current. The primary influencing parameters for the relative electrode wear ratio are pulse-on duration, the secondary are the pulse current. The primary influencing parameters for the surface roughness are the pulse current, the secondary is pulse-on duration. The primary influencing parameters for the hole enlargement are pulse-on duration, the secondary are the pulse current. The influencing effective parameters for the thickness of the transformation layer are pulse-on duration, the secondary is pulse current. From the full factorial experiment shows the material removal rate, the surface roughness, the hole enlargement and the thickness of the transformation layer, increase as the pulse-on duration and the pulse current increase. The next step is to conduct regression analysis to obtain the formula of experience for the material removal rate is MRR=0.000008(Ip0.81×Ton1.2). The formula of experience for the surface roughness is SR=0.0813(Ip0.59×Ton0.36). The formula of experience for the hole enlargement is HE=0.0045(Ip0.7×Ton0.3). The formula of experience for the thickness of the transformation layer is WLT=8.95(Ip0.05×Ton0.2).