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Abstract
Electro discharge machining (EDM) has wildly applications among non-traditional manufacturing. However, some defects like pores, cracks and craters induced due to huge temperature gradient of dielectric during cooling process. The molten material which is not flushing away by dielectric will be re-solidified on the machined surface, and will deteriorate the mechanical properties of the materials. Therefore, the addition of molybdenum among composite electrode to accrue surface integrity after EDM has been discussed in this study.
This study compares electrolytic coppers and copper based composite electrode by powder metallurgy when adding molybdenum of 0%, 10%, 20% and 30%. The sinter temperature is 850°C and 950°C, together with 288 MPa and 481 MPa to pressurization. In order to analyze the surface integrity of EDMed surface, EDM working parameters with peak current of 4A and pulse-on duration of 15μs are chosen. Moreover, Scanning Electron Microscopy(SEM) is performed to observe the surface topography, Energy Dispersive Spectrometer(EDS) and Transmission Electron Microscope(TEM) to analyze the molybdenum migrated from electrode to work piece. The relationship between electrode wear rate, recast layer thickness and surface cracks of molybdenum migration can also be established.
The results reveal that the microstructure of machined area can be divided into three zones: recast layer, heat affected zone and parent material with the heat dissipation. Carbide is easier to adhere to composite electrode which undergoing sintering one time than twice. Therefore, the tendency of electrode wear rate is not the same. The results also reveal that molybdenum migrated from electrode can elevate high temperature characteristic of work piece. With the addition of molybdenum in electrode increased, since the binding strength of composite electrode is relative weak, the molybdenum migrated also increased, and hence to depress the formation of surface crack. Furthermore, the plasma channel can also be dispersed by the addition of molybdenum, this also leads to lower the thickness of recast layer, and also achieve to depress the formation of surface crack.
Key words: EDM, composite electrode, crack
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