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Effect of process parameters on cutting speed of wire EDM process in machining HSLA steel with cryogenic treated brass wire

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ABSTRACT

Wire electrical discharge machining (wire EDM), a most common non-conventional machine tool, is extensively employed to produce precise, delicate and intricate profiled shaped parts especially from hard to machine materials. The performance of wire EDM is mainly based on the electrical conductivity of both electrode wires and workpiece materials. The aim of research is to increase cutting speed (*CS*) of high strength low alloy (HSLA) hardened steel by determining main contributing input process parameters and effect of cold treatment on electrical conductivity of brass wire at –70 °C. Fractional factorial design is used to determine the relationship of *CS* with input process parameters includes; open voltage, pulse on time, pulse off time, wire tension, flushing pressure of deionized water and brass wires (cold treated – CT, and non-cold treated – NCT). Empirical model for *CS* is developed based on selected input process parameters and their contribution is analyzed through ANOVA technique. It is learned that pulse on time, pulse off time and wire electrode are the main contributing input process parameters that provide assistance to increase *CS* of wire EDM. In wire electrodes, cold treated brass wire is observed as a best alternative to enhance machining performance with an increase of electrical conductivity by 24.5 %.

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Izvirni znanstveni članek

Vpliv procesnih parametrov na hitrost rezanja pri WEDM procesu pri obdelavi HSLA jekla s kriogeno obdelano medeninasto žico

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POVZETEK

Obdelava z žično elektroerozijo (WEDM), najpogostejša nekonvencionalna obdelovalna tehnika, je široko uporabljena za izdelavo natančnih, občutljivih in zapletenih profiliranih izdelkov, zlasti iz materialov, ki se težko obdelujejo. Učinkovitost WEDM temelji predvsem na električni prevodnosti tako elektrode oz. žice kot materiala obdelovanca. Namen te raziskave je povečati hitrost rezanja (CS) visoko trdnega nizko legiranega (HSLA) kaljenega jekla z določitvijo najpomembnejših vhodnih parametrov procesa in učinka hladne obdelave pri –70 °C na električno prevodnost medeninaste žice. Za določitev razmerja med CS in vhodnimi procesnimi parametri; električna napetost, vklop impulza, izklop impulza, napetost žice, tlak izpiranja deionizirane vode in načina obdelave medeninastih žic (hladno obdelano – CT, in ne hladno obdelano – NCT) je uporabljena delna faktorska analiza. Empirični model za CS je razvit na podlagi izbranih vhodnih parametrov procesa, njihov vpliv pa je analiziran s pomočjo tehnike ANOVA. Ugotovi se, da so vklop impulza, izklop impulza in žična elektroda glavni dejavniki, ki prispevajo k povečanju CS pri WEDM. Med žičnima elektrodama je hladno obdelana medeninasta žica boljša alternativa za izboljšanje zmogljivosti obdelave s povečanjem električne prevodnosti za 24,5 %.

PODATKI O ČLANKU

Ključne besede:
Žična elektroerozija (WEDM);
HSLA jeklo;
Medeninasta žica;
Kriogena obdelava;
Hitrost rezanja;
Parametri procesa

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