

Evaluation of the sustainability of the micro-electrical discharge milling process

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ABSTRACT

The sustainability evaluation of an industrial process is an actual issue: a process should not only grant part quality and high production rates at the lowest cost, but it should minimize its impact on the environment as well. Micro-EDM (Electrical Discharge Machining) is widely used in micro machining for its small force and high precision and environmental aspects related this technology are taken into account. In this paper, an evaluation of the micro-ED milling process concerning the sustainability manufacturing was made. For this purpose, a method to assess the sustainability process was developed, taking into account the energetic consumption, the environmental impact, the dielectric consumption, the wear of the electrode and the machining performance. This method was applied for the execution of micro-pockets using two workpiece materials, two types of electrode and five types of dielectric, both liquid and gaseous. This analysis permits the identification of the critical aspects of the micro-ED milling process from the point of view of the sustainability. The comparison between the different solutions in terms of electrode material and dielectric underlines interesting considerations about the usage of non-traditional dielectrics. As regards electrode material, the environmental impact process when brass electrode is adopted is lower than tungsten carbide electrode. As concerns dielectric, water reveals to be the most sustainable dielectric; vegetable oil and oxygen, proved to be valid substitutes to traditional dielectrics under several viewpoints, including sustainability.

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Vrednotenje okoljske trajnosti postopka obdelave z mikroelektroerozijo

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POVZETEK

Ocenjevanje okoljske trajnosti industrijskega procesa je pomembno vprašanje: postopek ne bi smel zagotavljati le kakovosti izdelkov in visokih stopenj proizvodnje z najnižjimi stroški, ampak mora tudi kar najbolj zmanjšati vpliv na okolje. Micro-EDM (mikroelektroerozijska obdelava) se zaradi majhnih sil in visoke natančnosti pogosto uporablja pri mikroobdelovanju, upoštevani pa so tudi okoljski vidiki, povezani s to tehnologijo. V tem prispevku je bila opravljena ocena procesa rezkanja z mikroelektroerozijsko obdelavo v zvezi s trajnostno proizvodnjo. V ta namen je bila razvita metoda za oceno okoljske trajnosti procesa, ki upošteva energijsko porabo, vpliv na okolje, porabo dielektrikov, obrabo elektrode in zmogljivost obdelave. Metoda je bila uporabljena za izdelavo mikrožepov z uporabo dveh materialov obdelovanca, dveh vrst elektrode in petih vrst dielektrikov, tekočih in plinastih. Analiza omogoča identifikacijo kritičnih vidikov procesa rezkanja z mikroelektroerozijsko obdelavo z vidika trajnosti. Primerjava med različnimi rešitvami v smislu elektrode in dielektrika poudarja zanimive vidike uporabe netradicionalnih dielektrikov. Kar zadeva material elektrode, je vpliv na okolje ob uporabi medeninaste elektrode manjši od elektrode volframovega karbida. Kar zadeva dielektrik, je voda najbolj trajnosten dielektrik; rastlinsko olje in kisik pa sta se v več pogledih, vključno z okoljsko trajnostjo, izkazala kot primerno nadomestilo tradicionalnim dielektrikom.

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PODATKI O ČLANKU

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Obdelava z elektroerozijo (EDM);
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Mikroelektroerozijsko rezkanje;
Okoljska trajnost;
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