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Graphene applications in Unconventional Machining Processes –A review

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ABSTRACT

Graphene is being involved widely in research worldwide because of its unique properties such as high thermal conductivity and electrical conductivity, which are very important in machining the hardest materials by Unconventional Machining Processes. Due to the unique properties of Graphene, the researches focusing on improving the performance of Unconventional Machining Processes diverts their researchers to analyze Graphene applications in those processes. Many types of research carried out in the analysis of Graphene as a wide variety of applications in Electrical Discharge Machining and Wire Cut Electrical Machining. In this paper, the applications of Graphene as a different role are reviewed and summarized.

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1. Introduction

Graphene has an atom-thick honeycomb structure of carbon atoms. It is the building block of graphitic materials. Nanographene is obtained from the process called dehydrogenation, where the hydrogen atoms are removed from organic molecules of carbon and hydrogen [25]. Graphene is the strongest material and possesses outstanding characteristics such as high electron mobility and high thermal and electrical conductivity. Graphene has unique properties [47–48]. It is the thinnest and strongest material. Thus these unique properties formulate the Graphene a most suitable one for various applications in electronics industries. The other areas where Graphene plays an important role are physics, chemistry, and materials science [42].

The process parameters of the WEDM process can be improved by adding different graphene concentrations in nano powder-mixed dielectric fluid [20]. TiC containing composite coatings with greater tribological properties was prepared by adding Reduced graphene oxide nanosheets (RGONS) as the additives of EDC dielectric fluid [21]. The deionized water (800 ml) mixed with graphene nanopowder at different concentrations results from the MRR improved by 21.27% and roughness by 18.91%. [22]. The graphene nanofluid was mixed with deionized water for machining Inconel 718 in EDM. The addition of graphene nanofluid showed good improvement in machining performance and the process parameters [23]. The approach for surface improvement of 55NiCrMoV7 tool steel surface integrity was implemented. The lower graphene oxide (RGO) flakes have been mixed in a dielectric liquid, and surface roughness has been decreased with an improved rate of material removal (MRR). RGO flashes decreased the decomposition voltage in an electric dielectric system and permitted many discharges in one pulse [24]. The kerosene dielectric incorporating graphene nanoparticles has been studied using the EDM Ti-6al-4V. The experimental findings indicated that there were more MRRs in the metal electrode with negative tool polarity for both types of dielectrics. The graphic dielectric wear rate was roughly 1.5 times lower with kerosene [25]. The decreased concentrations of graphene oxide (RGO) and the direction of the electric discharges (electrode polarity) significantly affect the integrity of surfaces. The surface roughness of the standard EDM technique may be reduced by roughly 2.5 times [26].

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