Potential of Electrically Conductive Chemical Vapor Deposited Diamond as an Electrode for Micro-Electrical Discharge Machining in Oil and Water

Anurag Sharma*, Manabu Iwai1, Kiyoshi Suzuki and Tetsutaro Uematsu1

Nippon Institute of Technology, Miyashiro, Saitama 345-8501, Japan
1Toyama Prefectural University, Kosugi, Toyama 939-0398, Japan

(Received 24 July 2004; accepted 16 November 2004)

Key words: micro-electrical discharge machining, electrically conductive diamond, chemical vapor deposited diamond thick film, low wear electrode

Low electrode wear is the key to achieving high finish and high accuracy machining in micro-electrical discharge machining (micro-EDM). Electrically conductive chemical vapor deposited (CVD) diamond has shown almost zero electrode wear, even at short pulse durations, which is extremely important for maintaining the electrode shape throughout the EDM process. This research involves an investigation into the effect of various EDM parameters on the EDM of die steel using electrically conductive CVD diamond with respect to electrode wear, efficiency and ED machined surface properties. The effect of Joule heating due to the high electrical resistivity of electrically conductive CVD diamond, which may cause deterioration of the ED machined surface is also studied. The results indicate that no deterioration of the workpiece surface occurs due to Joule heating when EDM is performed using an electrically conductive CVD diamond electrode. An investigation into the factors responsible for the low wear of the CVD diamond electrode leads us to deduce that an accelerated adhesion of the heat-resolved carbon on the electrode surface along with the high thermal stability of the diamond are mainly responsible.

*Corresponding author: e-mail: anuragsharma@hotmail.com