**Hot pressing of Copper and Copper-based Composites: Microstructure and Suitability as Electrodes for Electric Discharge Machining**

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**ABSTRACT**

High conductivity of copper is exploited as an electrode material for electrical discharge machining of conducting materials such as steel. However, the tool also wears out during the machining necessitating the use of composites for increased life. The composite electrodes, in general are prepared using powder metallurgical approaches. In the present paper, hot pressing is employed as a method of manufacture of possible electrodes in copper-tungsten, copper- tungsten – carbon (as graphene) and copper-zirconium diboride. Typically, all the necessary powders were milled for 60 minutes in tungsten carbide vessel with tungsten carbide grinding media. The powders were consolidated in a graphite die with graphite punches for 4 minutes at 900C in to bars of 10 mm square cross sections and 55 mm length. The densities, hardness and electrical conductivity of the hot-pressed bars were measured using Archimedes method, micro Vickers and standard IACS methods respectively. 10 mm cubic samples were cut from the bars and were brazed to pure copper rods tested for their suitability as electrode materials for electrical discharge machining of AISI D3 steel. The observed results are correlated with the density, hardness, electrical conductivity and composition. It was found that the densities of more than 90% were obtained for all the compositions with increased additions resulting in lower conductivity and increased hardness. Both tool removal rate and Material removal rates were observed to be increased. However, the surface finish can be tailored by a suitable combination of composition, machining parameters. The observed results are correlated with microstructural features observed as result of hot pressing in terms of distribution, grain size and bonding between the different particles.

*Keywords: Copper based composites; Hot pressing; Electric Discharge Machining; Microstructure.*