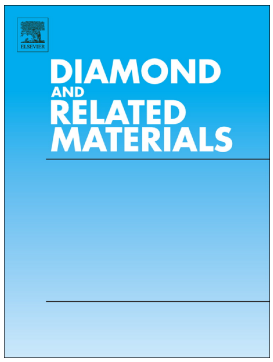

Comparative study on interfacial microstructure and cutting performance of tunnel furnace and vacuum furnace brazed diamond core-drill

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Comparative study on interfacial microstructure and cutting performance of tunnel furnace and vacuum furnace brazed diamond core-drill

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Abstract: The diamond core-drills were brazed with Ni-Cr filler alloy in the tunnel furnace with the characteristics of the continuous heating and in the vacuum furnace, respectively. The surface morphology and interfacial microstructure between diamond and filler alloy, and filler alloy and substrate were characterized using scanning electron microscopy, energy spectrometer and X-ray diffraction. The effect of different cooling methods on the microstructure and micro-hardness of the filler alloy and substrate was investigated. Furthermore, the drilling tests were conducted, and the cutting efficiency, service life and wear behavior for both tools were comparably analyzed. The results demonstrated a layer of Cr-C compound formed at the interface of diamond and filler alloy, and a diffusion band composed of Ni and Fe solid solution or compound formed at the interface between filler alloy and substrate regardless of fabricating technique. The thickness of the Cr-C compound, the width of the diffusion band, the micro-hardness of the substrate and the molten solidified filler alloy for the tunnel furnace brazed diamond core-drill were greater than that of vacuum brazed tool. After drilling polished tiles using diamond core-drill, the cutting efficiency and service life of the tunnel furnace brazed core-drill were close to that of the vacuum brazed core-drill. The attrition wear was the main wear mode for both kinds of tools, and neither the pullout nor the fracture of the abrasive grains occurred during the machining.

Keywords: Diamond brazing; Tunnel furnace; Vacuum furnace; Interfacial microstructure; Cutting performance; Wear behavior

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