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Metallic-Diamond Tools with Increased Abrasive Wear Resistance for Grinding Industrial Floor Systems

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Abstract : This paper presents the results of research on the physical, mechanical, and tribological properties of materials constituting the matrix in sintered metallic-diamond tools. The ground powders based on the Fe-Mn-Cu-Sn-C system were modified with micro-sized particles of the ceramic phase: SiC, Al_2O_3 and consolidated using the SPS (spark plasma sintering) method to a relative density of over 98% at 850-950°C, at a pressure of 35 MPa and time 10 min. After sintering, an analysis of the microstructure was conducted using scanning electron microscopy. The resulting materials were tested for the apparent density determined by Archimedes’ method, Rockwell hardness (scale B), Young’s modulus, as well as for technological properties. The performance results of obtained diamond composites were compared with the base material (Fe–Mn–Cu–Sn–C) and the commercial alloy Co-20% WC. The hardness of composites has achieved the maximum at a temperature of 900°C; therefore, it should be considered that at this temperature it was obtained optimal physical and mechanical properties of the subjects' composites were. Research on tribological properties showed that the composites modified with micro-sized particles of the ceramic phase are characterized by more than twice higher wear resistance in comparison with base materials and the commercial alloy Co-20% WC. Composites containing Al_2O_3 phase particles in the matrix material were composites containing Al_2O_3 phase particles in the matrix material were characterized by the lowest abrasion wear resistance. The manufacturing technology presented in the paper is economically justified and can be successfully used in the production process of the matrix in sintered diamond-impregnated tools used for the machining of an industrial floor system. Acknowledgment: The study was performed under LIDER IX Research Project No. LIDER/22/0085/L-9/17/NCBR/2018 entitled “Innovative metal-diamond tools without the addition of critical raw materials for applications in the process of grinding industrial floor systems” funded by the National Centre for Research and Development of Poland, Warsaw.

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