SINTERING TEMPERATURE OPTIMIZATION OF ULTRA-FINE TUNGSTEN CARBIDE COBALT (WC-CO) TOOL INSERT WITH ADDITION OF CARBON (C) AND VANADIUM CARBIDE (VC)

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ABSTRACT

Production of Tungsten Carbide Cobalt (WC-Co) tool inserts have been the subject of interest for multiple research programmes around the world, with the hope of improving mechanical properties as the result from reducing grain size from sub-micron level to ultra-fine level. WC-Co tool inserts are manufactured through powder metallurgy (PM) route where sintering is the key process. However, the optimum sintering temperature of ultra-fine WC-Co has not yet been identified. Inappropriate sintering temperature may contribute to lower mechanical properties. Lower sintering temperature will lead to incomplete sintering while too high sintering temperature will contribute to grain growth activities. In this work, the optimized sintering temperature was studied on WC-Co tool insert with the addition of 0.2% carbon and 0.6% vanadium carbide. The samples were fabricated by PM process and sintered in Nitrogen 95%-Hydrogen 5% environment at three different temperatures of 1350°C, 1400°C, and 1450°C with constant heating rate and 1 hour holding time. The effect of sintering temperature on the mechanical properties of WC-Co-C-VC was determined by transverse rupture strength (TRS) test, Vickers hardness test, density measurement, and microstructure analysis. Test results implies that samples sintered at 1400°C exhibits the best TRS, hardness, and density values along with desired microstructures formation.