Synthesis of the nanostructured powder for thermal spray coating

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Introduction

Thermal sprayed WC/Co coatings have been widely applied to machine component for protection the material surface. During the short residence time in the hot zone, the particles are rapidly heated to form a spray of partially or completely melted droplets. The micron-sized WC/Co feedstocks experience surface melting only, which contracts with the homogeneous or bulk melting of the nanostructured WC/Co. The nanostructured particles, due to their melting characteristics, will be able to form a dense and harder coating when they impinge on the substrate. The large impact force created as these particles arrive at the substrate surface promote strong particle-substrate adhesion and the formation of a dense coating.

The present study was focused on producing nano-WC/Co powder for thermal spraying and compared the properties of HVOF sprayed nanostructured and conventional WC/Co coating.

Experimental

Nanostructured WC/Co powder was produced by MCP process[1], which using the aqueous solution mixture of salts of the W and Co. To use for thermal spraying, the nanostructured powder were spray dried to form solid agglomerates, and heat treated to consolidate the agglomerated particles. Typically, the powder was screened to a relatively narrow particle size distribution(20-75㎛), which is preferred size range for use in commercially available powder feed systems. Thermal spraying was carried using a JP-5000 gun(TAFA), operating under standard conditions.

Result and Discussion

The reconstituted powder feedstocks have a near spherical morphology with particle size distribution ranging from 20-90㎛ in diameter. The individual WC grains with in each nanocomposite particle are about 100-150nm. As reconstituted nanostructured WC/Co particle exhibited some degree of porosity, these porosity are eliminated after post-sintered at elevated temperature. Fig. 1. shows the typical SEM micrographs of the as-postsintered nanostructured WC/Co powders. Apparent density of the powders is over 3.8g/cc.

Typical SEM micrographs of the coating cross-sections are showing in Fig. 2. All these coatings are very dense and visual examination of the SEM micrographs reveal less than 2% coating porosity.

Reference

(1) G.H.Ha, B.K.Kim, Synthesis of ultrafine WC/Co powder by mechanochemical process, Powder Metallurgy, vol. 45, No. 1, p29

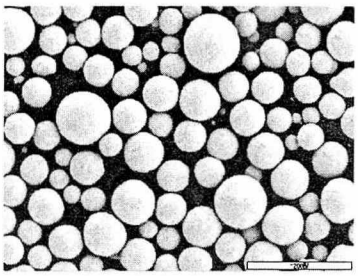
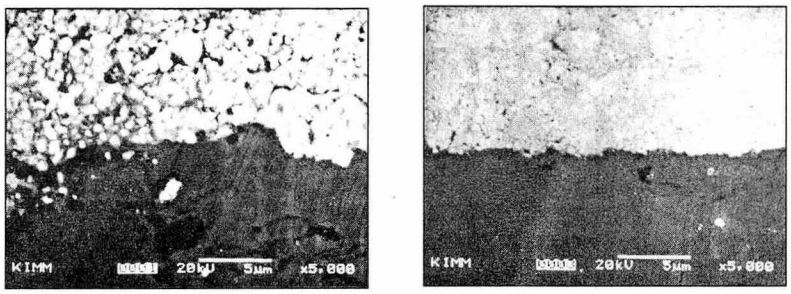


Figure 1. shows the typical SEM micrographs of the as-postsintered nanostructured WC/Co powders



Commercial powder Nanostructured powders

Figure 2. SEM micrographs of the coating cross-sections