CHARACTERIZATION OF SPARK PLASMA SINTERED GRAPHENE-COATED STAINLESS-STEEL COMPACTS

A.D. Akinwekomi, F. Akhtar [1]*, Mamoun Taher[2]

[1] *Division of Materials Science, Luleå University of Technology, 97187 Luleå, Sweden*
[2]*Graphmatech AB, 753 18 Uppsala, Sweden*

* farid.akhtar@ltu.se

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ABSTRACT

We investigated the effect of sintering temperature and graphene content on the microstructure, densification, hardness, and wear properties of spark-plasma sintered (SPS) graphene-coated 316L stainless-steel powders. Four sintering temperatures (850, 900, 950, and 1000 °C) and graphene content of 0.01, 0.1, and 0.5 wt.% were investigated. Results showed that sintered density increased with the sintering temperature. Microstructural examination corroborated this result as distinct unsintered powder particles, sinter necks and large interparticle pores observed at 850 °C were annihilated at 1000 °C. The 316L stainless steel sintered specimen had a density of 7.27 g/cm^3, which decreased slightly with increasing graphene content to 7.17 g/cm^3 for the sample with 0.5 wt.% graphene coating. The sintering temperature and graphene content appeared not to have significant effect on the microhardness. For instance, microhardness for the reference 316L sintered specimen was 189 HV, compared to ~ 171 HV for all the graphene-coated 316L sintered specimens. X-ray diffraction analysis did not detect the formation of carbides in the sintered samples, which suggested that the sintering process minimized its formation. Raman spectroscopy indicated that sintering at 850 °C preserved the structure of graphene during the spark plasma sintering process.