Arc welding of Ni-CNTs@316L nanocomposite for industrial applications

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In recent years some progress has been made about incorporation of Carbon Nanotubes – CNTs in metal matrix by arc welding. Despite that, there is scarce information relating to microstructural modifications induced by nanomaterial in the welding metal. In this sense, we present the incorporation of nanocomposite based on Nickel/Carbon Nanotubes@stainless steel 316L alloy – Ni-CNTs@316L via Gas Tungsten Arc Welding Pulsed – GTAW-P in the surface of a metal matrix based on manganese steel namely as base metal. The manufactured specimens with/without nanocomposite were characterized by: optical microscopy – OM; scanning electron microscopy – SEM with energy dispersive spectroscopy – EDS and electron backscattering diffraction – EBSD; transmission electron microscopy – TEM combined with focused ion beam – FIB. Moreover, Vickers microhardness tests were performed in the following regions: welding metal (WM), fusion line (FL), heat-affected zone (HAZ) and base metal (BM). The results show that: the dilution rate and grain size for specimens were: with nanocomposite > without nanocomposite; the CNT does not turned in carbides, but it affected the misorientation angle and Euler space changing the recrystallization of WM; the superior microhardness from WM with Ni-CNTs was on average 26% higher than BM, but relatively to the same that WM without Ni-NTCs; and the formation of a martensite phase in the HAZ increases the microhardness in 75% when compares with BM. These results indicate that incorporation of nanocomposites in the metallic matrix by electric arc welding is a fertile ground for new applications in the manufacturing industry.

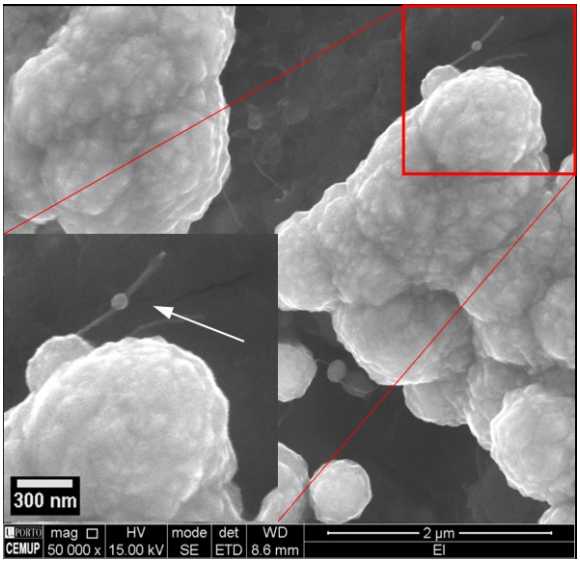

Figure - Welding electrode with carbon nanotubes (white arrow).

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