

Microstructure and mechanical behavior of dissimilar AISI 304L/WC-Co cermet rotary friction welds

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Abstract: In this work, dissimilar rapid Rotary Friction Welding of WC-Co cermet to AISI 304L austenitic stainless steel has been conducted using different friction times. The microstructural examination showed that the increase in friction time from 4s to 12s increases the grain size in both the heat affected zone and the thermo-mechanically affected zone and enlarges the extent of the fully dynamically recrystallized zone. EDS analysis revealed the existence of a Fe-Cr-W rich band along the WC-Co/AISI 304L interface in the central region of the weld joint and its absence from the peripheral region. The formation of this band suggests the occurrence of mutual inter-diffusion between the cermet and the steel which enhanced the metallurgical bonding of the interface. The mechanical behavior investigated by nano-indentation measurements and nano-scratch tests revealed that, regardless the friction time effect and considering the 304 L ASS side, the highest hardness (HIT) and the lowest Young's modulus (EIT) values were recorded in the fully dynamically recrystallized zone. Besides, the increase of friction time resulted in an increase of hardness and Young's modulus of each zone in the AISI 304L steel side.

Keywords : Rotary friction welding, WC-Co cermet, AISI 304L ASS, microstructure, Inter-diffusion, Bonding strength.