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Wear Assessment of SS316l-Al2O3 Composites for Heavy Wear Applications

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Abstract : The abrasive wear of composite materials is a major challenge in highly demanding wear applications. Therefore, this study focuses on fabricating, testing and assessing the properties of 50wt% SS316L stainless steel–50wt% Al2O3 particle composites. Composite samples were fabricated using the powder metallurgy route. The effects of the powder metallurgy processing parameters and hard particle reinforcement were studied. The microstructure, density, hardness and toughness were characterized. The wear behaviour was studied using pin-on-disc testing under dry sliding conditions. The highest hardness of 1085.2 HV, the highest theoretical density of 94.7% and the lowest wear rate of 0.00397 mm3/m were obtained at a milling speed of 720 rpm, a compaction pressure of 794.4 MPa and sintering at 1400 °C in an argon atmosphere. Compared to commercial SS316 and fabricated SS316L, the composites had 7.4 times and 11 times lower wear rate, respectively. However, the commercial 90WC-10Co showed 2.2 times lower wear rate compared to the fabricated SS316L-Al2O3 composites primarily due to the higher ceramic content of 90 wt.% in the reference WC-Co. However, eliminating the relatively high porosity of about 5 vol% using processes such as HIP and hot pressing can be expected to lead to further substantial improvements of the composites wear resistance.

Keywords : SS316L, Al2O3, powder metallurgy, wear characterization
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