TRIBOFILM FORMATION DURING DRY SLIDING OF GRAPHITE- AND M_OS_2-BASED COMPOSITES FABRICATED BY SPARK PLASMA SINTERING

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KEYWORDS
Solid lubrication; Tribofilm and third body; Friction, SPS sintering

ABSTRACT

This work investigates the effect of the microstructure on tribofilm formation during the dry sliding of graphite- and MoS_2-based composites fabricated by Spark Plasma Sintering (SPS) . Mixtures of Astaloy 85Mo steel with the addition of 8 wt.% of MoS_2 or graphite or a mixture with 4 wt.% of graphite and 4 wt.% MoS_2 were obtained by SPS at 950 C, 60 MPa and 5 min as sintering parameters. The identification of crystalline phases was conducted by X-ray diffraction (XRD), and the observation of the morphology of secondary phases, as well as microstructural defects, was conducted using field emission scanning electron microscopy (FESEM). Dry sliding wear tests were conducted at different normal loads (5, 10 and 20) N with sliding speed of 0.1 m. s^{-1} using sintered samples and an AISI 52100 steel ball as counterpart. The top surface of the wear track and the tribolayer cross-section were analyzed using Raman spectroscopy and energy dispersive X- ray spectroscopy (EDS). The effect of the contact pressure on the extrusion of solid lubricant particles was investigated using instrumented indentation (Fig. 1) and scratch tests. Graphite addition to the steel matrix composite provided the formation of a protective tribolayer, which lead to lowest values of friction coefficient (Fig. 2) and wear rate. For the two MoS2-containing composites, both the modification of the layered structure by formation of Fe-Mo-S secondary phases during sintering and the higher amount of oxidative wear products resulted in a significant increase in the friction coefficient at the highest normal loads. For the MoS_2/graphite-containing composite, the synergistic effect of the two solid lubricants, resulted in samples with intermediate friction coefficient and the highest hardness (57%), in comparison to the Astaloy 85Mo steel.

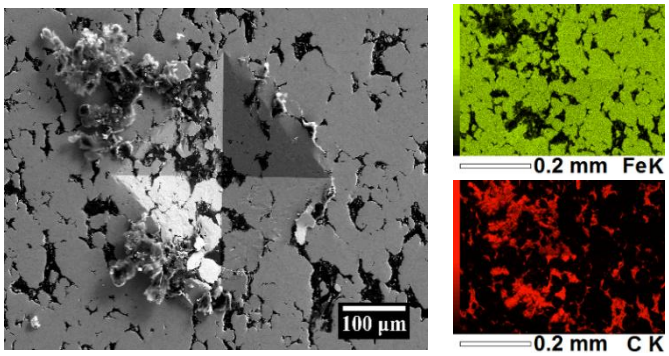

Fig.1 SEM and EDS images of graphite particles extrusion after Vickers indentation with a load of 10 kgf

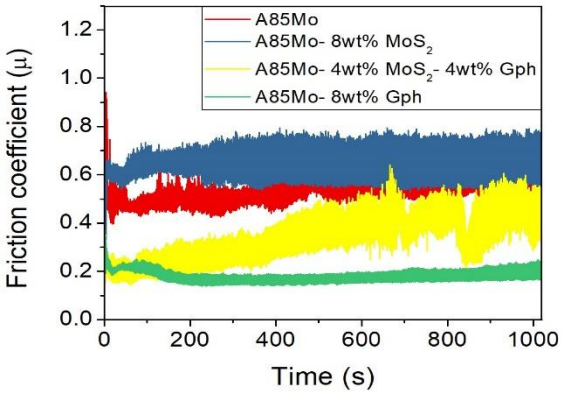

Fig.2. Friction coefficient of the sintered composites under dry sliding test at 20 N of applied load

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