Microsc. Microanal. 26 (Suppl 1), 2020

doi:10.1017/S1431927620000793

Morphological and tribological analysis of synthetic and commercial sulfures

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Lubrication reduces friction between two surfaces that slide over each other and prevents welding under high load conditions. Many lubricant bases enhance their applications by the addition of additives. Among them, extreme pressure (EP) additives provide properties that can withstand high load conditions, high temperature and high sliding speeds because they provide a low friction or wear interface to make contact between the metal parts more efficient [1]. The addition of additives enhances lubricants applications by providing specific properties suitable for enduring conditions.

In this work, the morphology and tribological behavior of bismuth sulfides (Bi_2S_3) and molybdenum sulfides (MoS_2) nanoparticles obtained by solvotermal synthesis and those used in commercial additives were compared.

Samples were dispersed on an aluminum conductive adhesive tape (3M®) and metallized with gold in a sputter coater. The observation was performed in a LEO EVO 40-XVP SEM operated at 10 kV. Images of representative areas were acquired, at different magnifications (25000x and 30000x).

Particles images of solvotermal and commercial Bi_2S_3 are shown in Figure 1. In the first case, elongated particles are observed (2.5 .mu.m length, width and thickness 100 nm 220 nm approximately.). They are grouped in rosette form (~5 µm in diameter). The commercial additive presents a morphology of stacked flat plates with agglomerates of different sizes. These plates have a length of ~6 µm and a thickness of ~5 µm. On the other hand, morphologies of MoS_2 obtained for solvotermal and commercial nanoparticles are shown in Figure 2. A uniform pseudo-spherical aggregates of ~0.5-0.8 µm in diameter are observed for solvotermal MoS_2. Commercial additive nanoparticles exhibited laminar agglomerates of different sizes and shapes. (3-5 µm in length and 0.5-0.7 µm in thickness).

In addition, Figures 1 and 2 show the Reichert wear tests results for bismuth and molybdenum sulphides as additives in a silicon-based lubricant. It is note, morphological differences help to explain the tribological behavior observed. An increase in additive particles leads to better lubrication. The fact that Bi_2S_3 is a stratified solid suggests that cross-layer cutting provides lubricity in EP tests.

In conclusion, the correspondence between morphology and tribological behavior of synthetic and commercial additives was observed. The increase in the amount of additive favors the lubricating power. In addition, Bi_2S_3 showed better performance than MoS_2.

References:

[1] Y. Y. Wu, W. C. Tsui and T. C. Liu, Wear **262** (2007), p. 819.
[2] Y. Li, F. Wei, Y. Ma, H. Zhang, Z. Gao, L. Dai and G. Qin, CrystEngComm **5** (2013), p. 6611.
[3] X. Zhang, X. Huang, M. Xue, X. Ye, W. Lei, H. Tang, and C. Li, Materials Letters **148** (2015), p. 67.
Authors wish to thank PLAPIQUI, INQUISUR, IFISUR, ANPCyT y CONICET for their financial support.

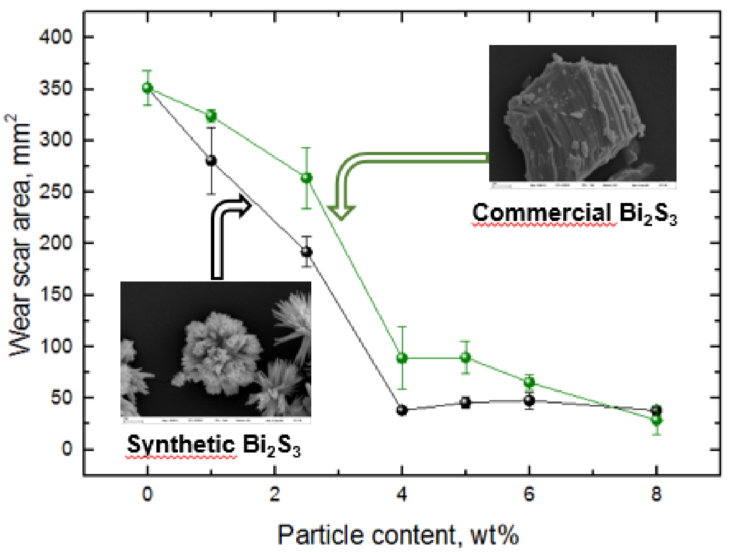

Figure 1: SEM micrographs and Reichert test results for Bi_2O_3.

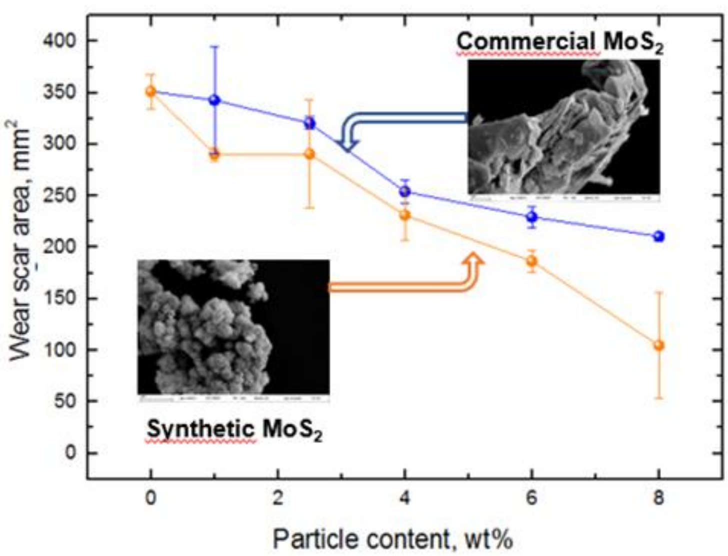

Figure 2: SEM micrographs and Reichert test results for MoS_2.

https://doi.org/10.1017/S1431927620000793 Published online by Cambridge University Press