SELF-LUBRICATING COMPOSITES: EFFECTS OF SIZING AND MIXED LUBRICATION ON TRIBOLOGICAL PERFORMANCE.

Letícia Maria Anselmo [a], Thiago de Souza Lamim [b], José Daniel Biasoli de Mello [a,c*], Aloisio Nelmo Klein [a], Gisele Hammes [a], Cristiano Binder [a]

* d.mello@labmat.ufsc.br;ltm-demello@ufu.br (J.D. B de Mello)

[a] Laboratório de Materiais, Universidade Federal de Santa Catarina – UFSC, Campus Trindade, Florianópolis, SC, 88040-900, Brazil

[b] Materials Research and Technology department (MRT), Luxembourg Institute of Science and Technology (LIST), Esch-sur-Alzette, 4362, Luxembourg

[c] Faculdade de Engenharia Mecânica, Universidade Federal de Uberlândia – UFU, Uberlândia, MG, 38400 901, Brazil

KEYWORDS

Mixed Lubrication; Solid lubrication; Surface topography; Self-lubricating composite.

ABSTRACT

This work investigates the effect of fluid lubrication (linear alkylbenzene oil ISO 5 with 2% wt. of the anti-wear additive butylated triphenyl phosphate – BTP) on the tribological behaviour of self-lubricating composites produced by powder metallurgy. In addition, the influence of sizing (as sintered and sized at 320 MPa0 was studied. Furthermore, this study compares the combined effect of mixed lubrication with the isolated effect of fluid and solid (dry) lubrication on the formation and maintenance of the tribolayer.

The wear rate and the friction coefficient behaviour were evaluated by reciprocating sliding tests using a ball-on-flat configuration under constant load. Scanning electron microscopy, energy dispersive X-ray spectroscopy, and micro Raman spectroscopy were used to characterize the morphological and structural aspects of the wear scars and the tribolayers. Due to the inherent high porosity of sintered material, a methodology was developed to impregnate the material before the tribological tests and thus saturate the internal voids with the same fluid lubricant used in the test.

An increase in the average steady-state friction coefficient was observed by adding oil to the self-lubricating composites, regardless of the surface topography (Fig. 1a). On the contrary, the surface topography played an essential role in the tribological response of the dry tests, as seen by a decrease of wear rate for the specimen sized at 320 MPa (dry test, Fig. 1b). On the other hand, in the presence of oil the wear rates become similar for both topographies (wet test), indicating that the fluid lubrication dominates and superposes the topographic effect.

Surprisingly, adding oil increased the wear rate of the sized specimen by a factor of 2.4. Raman's results showed that the carbonaceous tribolayer on the surface of the specimens is significantly less disordered for the wet tests, suggesting the shearing lubricating mechanism of graphite responsible for the self-lubrication of the composites is affected under mixed lubrication [1].

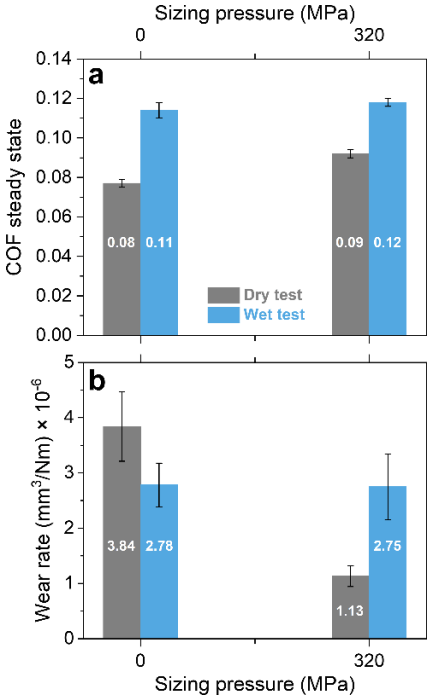

Fig.1 (a) COF of the tribosystems and (b) wear rates

REFERENCES

[1] Neves, G. O. et al. "Tribologically induced nanostructural evolution of carbon materials: a new perspective." Friction 12(1): 144-163 (2024).