LAB SCALE OPTIMIZATION OF DC MAGNETRON SPUTTERED C DOPED MoSe2 SOLID LUBRICANT COATINGS

T. B. Yaqub*[1, 2], T. Vuchkov[1, 2], M. Evaristo[2], A. Cavaleiro[1, 2]

*talha.yaqub@ipn.pt

1 IPN - LED & MAT - Instituto Pedro Nunes, Laboratory of Tests, Wear and Materials, Rua Pedro Nunes, 3030-199 Coimbra, Portugal

2 SEG-CEMMPRE, Department of Mechanical Engineering, University of Coimbra, Rua Luís Reis Santos, 3030-788 Coimbra, Portugal

KEYWORDS

Coating; Solid Lubrication; Friction, Wear

ABSTRACT

The study involves the investigation of magnetron sputtered Mo-Se-C coatings for low friction tribological applications attributed to their excellent sliding properties in vacuum and humid environment conditions. Depositions were done using dc magnetron sputtering of seperate $MoSe_2$ and carbon targets, with and without the application of substrate bias voltage. Carbon content variation from 44-60 at. % was achieved utilizing different C target powers. Wavelength dispersive spectroscopy (WDS) showed a maximum Se/Mo ratio of 1.88 for the 50 at. % carbon coating deposited without substrate bias, while the ratio decreased with the application of substrate bias, possibly attributed to re-sputtering effects of Se during coating growth. Featureless and compact cross-sectional morphologies were observed in Scanning Electron Microscopy (SEM). X-ray diffractions utilizing grazing incidence mode depicted a broad amorphous diffraction pattern without any evidences of $MoSe_2$ platelets but Transmission Electron Microscopy (TEM) clearly depicted the presence of randomly oriented $MoSe_2$ platelets in amorphous C matrix, irrespective of substrate bias application. Crystalline $MoSe_2$ peaks in addition to characteristic G and D peaks for amorphous C were observed during Raman analysis. Nanoindentation hardness measurements displayed superior results for the coating deposited with 90 V substrate bias. Lowest friction coefficient of 0.05 in humid environment while 0.025 in dry nitrogen environment for 90 V substrate bias coatings were observed during reciprocating sliding tribotests, performed under 30 N load. Much improved and superior results than literature were achieved during this research [1,2]and it paves way as a first step towards industrial implementation of the system.

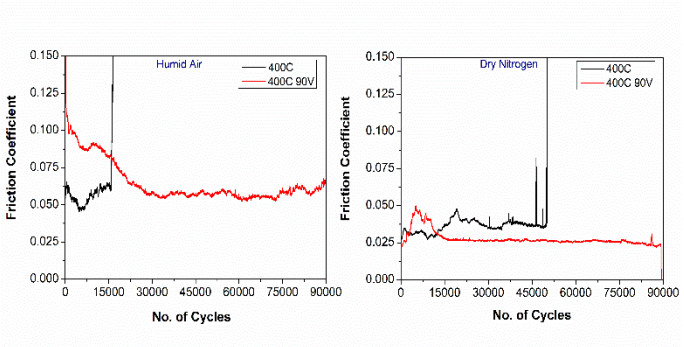

Figure 1 Friction curves of coatings deposited with and without substrate bias

Table 1 Chemical composition of the coatings

Coatings	C (at. %)	Mo (at. %)	Se (at. %)	O (at. %)	Se/Mo
330C	44	19	34	3	1.79
400C	50	16	30	4	1.88
500C	60	13	24	3	1.85
400C(50V)	55	15	25	5	1.67
400C(70V)	51	17	28	4	1.64
400C(90V)	51	18	28	3	1.59

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