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Laser structural patterning for accelerating the self-adaption mechanism in low friction W-S-C coatings

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One of the main problems of low friction TMD-based coatings (transition metal dichalcogenides), is the need to supply enough energy for promoting the self-adaption mechanism which allows the re-orientation / crystallization of TMD crystals. If such a transformation occurs, the alignment of the (001) planes parallel to the sliding direction can give rise to very low friction forces. Then, high shear stresses and/or long running-in periods are needed to achieve this interesting tribological performance. However, in many applications (e.g. in contact with rubber) the low contact stresses impede this self-adaption phenomenon, particularly when TMD-based coatings have high mechanical strength. Only for pure soft TMD coatings the realignment of the planes is possible. In this presentation, we are proposing to partial laser treat a hard self-lubricating coating of W-S-C system in order to optimize its frictional performance from the very first moments of the sliding contact. W-S-C films were deposited by closed field unbalanced magnetron sputtering. The coatings were treated using two types of lasers, with peak emissions in the UV and IR, under different laser power conditions and patterning. The structure, mechanical and tribological properties of the treated coatings were analysed using X-ray diffraction (XRD), Raman spectroscopy, nanoindentation and reciprocating ball-on-disk tribometry. Although XRD diffractograms illustrated an overall amorphous structure in all as-deposited and treated samples, their Raman spectra confirmed the presence of WS_2 crystalline phase in some of the treated areas. Furthermore, in the samples where WS_2 Raman peaks were detected, the friction coefficient was in the initial part of the test lower than that of untreated coating.

Keywords
Self-adaption
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TMD
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W-S-C