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ANALYSIS OF TRIBOLOGICALLY INDUCED CHANGES IN TA-C COATINGS

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ABSTRACT

DLC coatings are known for their outstanding tribological properties. Some coatings show a topographic and tribochemical running-in behavior. The tribological load induces a smoothening and a change in the subsurface of the DLC coating, the sp^2 content increases.

In the present work, we analyze the changes in a t:a-C coating due to a load in the ultra-low wear regime and compare XPS and XAES depth profiles with EELS measurements carried out on TEM lamellae. The XPS depth profiles were measured by sputtering with argon cluster ions. The sputtering depth was calibrated on a reference layer on a Si wafer and damage caused by the Ar cluster ions was investigated on diamond and graphite samples.

All methods show an increase in the sp^2 content due to tribological stress. The depth of tribologically induced modification in the spikes of the layer is approx. 70 nm. With 60 %, the sp^2 content from EELS results is significantly higher than the content measured via XPS. The difference is explained by preparation artefacts [1] and the fact, that XPS signal is also collected from areas that have not been in tribological contact.

It is also possible to analyze the subsurface volume of DLC coatings using XPS in combination with Ar clusters. Depending on the specific problem, the method can be advantageous compared to a TEM analysis, as the volume under consideration is larger and possibly more representative for a friction track.

REFERENCES

[1] Mangolini et al.; “Quantification of the carbon bonding state in amorphous carbon materials: A comparison between EELS and NEXAFS measurements”, Carbon 2021, 173, 557-564.