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Résumé

The nature of contact interface of skin, clothes or joints is the prime interest with metallic biosensors can be enhanced through PVD processes in terms of chemistry and microstructure. Furthermore, dynamic evaluation of the contact at the early stage is essential to better understand the wear mechanism of the corresponding bio-device. Therefore, within this thesis, a laboratory-made micro-tribometer was developed. This particular reciprocating ball-on-disk stage is coupled with an environmental SEM (eSEM) to characterise the tribological behaviour of materials, at small scale in situ realistic conditions.

To express the proof of concept, a preliminary analysis was performed with TiN PVD coatings. The testing procedure for the dynamic approach during the run-in period was defined in controlled atmosphere in eSEM. When the tribological tests were performed, the films were examined in situ, while the ball track was analysed in post mortem mode. Once validated, the mini-tribometer was used for a metal preferred in biosensors: titanium. Titanium presents a biocompatible character, with interesting mechanical properties. The wear character of pure Ti-film can be enhanced with an addition of proper alloying elements. Here, silver is an outstanding material regarding its anti-bacterial character, ductility, and remarkable sliding behaviour. Thus, Ti-Ag films were deposited with magnetron sputtering PVD with several Ag contents. It was seen that with increasing Ag content, a denser microstructure with Ag-based clusters into the film was achieved with a slight improvement on mechanical and electrical behaviours. During in situ analysis, the small-scale strategy of characterization highlighted the influence of humidity on tribological behaviour of these films. Finally, the effect of Ag content was studied in humid conditions. While it is known that Ag performs good sliding behaviour in ambient air conditions, it was seen that increasing humidity affect the sliding behaviour of Ag-based clusters.