MICROSHEAR MECHANICAL PROPERTIES MEASUREMENTS ON TRIBOLAYERS

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Surfaces in contact are usually submitted to wear and friction. Controlling these mechanisms allows the reduction of material lost costs and energy consumption: a both an economical and a sustainable focus. Consequently, the understanding of the tribological behavior of surfaces in contact, which is mainly related to the shear flow of the loaded interface, is necessary. Whilst “Nanoindentation” and “Microcompression” techniques are usually used to describe the surfaces mechanical properties, these techniques are not designed to unravel the shear flow involved in tribological systems.
The purpose of this study is the measurement, at the micron scale, of the shear mechanical properties for the protective glaze layer formed during high temperature fretting wear process. The involved substrates consist of a cobalt based alloy subjected to fretting against alumina (as shown in fig. 1), triggering the spontaneous formation of a third body at the interface, which presents excellent tribological properties with a relatively low and stabilized friction coefficient, and a quasi no-wear regime. Investigations on the formation, microstructure description and wear resistance of this third body were previously published (see [1] and [2]).
The experimental setup for this study involves a recently developed method allowing the measurement of shear properties at the micron scale [3]. The method consists of using microshear compression specimen, which geometry was inspired from macroscopic shear compression specimen [4], with FIB machined microscopic pillars containing two grooves inclined at 45° (see figure 2). These specimens were then compressed in a SEM *in situ* microindenter at high temperatures. The geometry and the method were experimentally and numerically (via FE simulations) validated on glass silicate, showing good reproducibility and localized plastic deformation on the gauge [3]. In this poster, the results obtained on specimen machined in the glaze layer and in a nanocrystalline Nickel will be presented along with numerical simulations using a multibody meshfree approach.

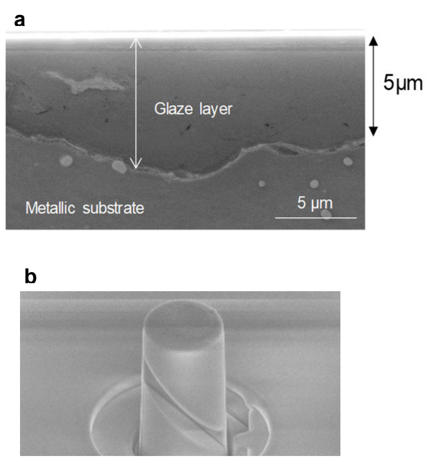

Figure 2 – SEM images of a) a cross section of the glaze layer [2] and b) an example of the microshear compression specimen, FIB machined on glass silicate [3].

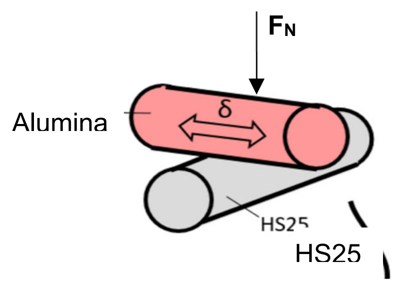

Figure 1 – Alumina/Cobalt alloy cross-cylinders configuration used to form the glaze layer [1].
F_N : Normal load; δ : Fretting displacement.

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[2] Viat A. et al., “Brittle to ductile transition of tribomaterial in relation to wear response at high temperatures”, Wear (2017)
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