GLAZE LAYER FORMATION MODALITIES: FROM NANOSTRUCTURED WEAR DEBRIS TO GLOBAL ENERGY DISSIPATION

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KEYWORDS

glaze layer; wear; cobalt; ceramic; high temperature

ABSTRACT

A compact debris bed can be formed at high temperatures in a contact between two metals. This third body is usually called “glaze layer” and has also been created and described in a metal-ceramic contact in a previous study [1]. When formed, the glaze layer protects the interface from wear and provides low friction thanks to its nanocrystalline structure.

In the present work, the focus is on the formation process according to two approaches: the microstructural genesis and the influence of fretting parameters on the energy dissipated to create the glaze layer.

Firstly, the glaze layer formation mechanism has been studied through morphological observations with SEM and TEM-FIB (fig.1). It begins with nanograins whose size does not change from the early debris generation to the final sintering process, suggesting the leading role of dynamic recrystallization rather than grinding of already detached debris.

Secondly, the glaze layer formation has been quantified in defining N_{GL} as the number of cycles necessary to create the glaze layer (fig.2). N_{GL} is the basis of energy wear calculations to compare the effects of mean sliding speed varying with frequency and sliding amplitude. The influence of some fretting parameters [2] is extended here to high temperature lubricious phenomena.

The energy brought to third body creation is then interpreted in light of nanoscopic behavior of debris. Final aim is to anticipate the needed debris generation and time necessary to form the glaze layer, regarding a given fretting configuration.

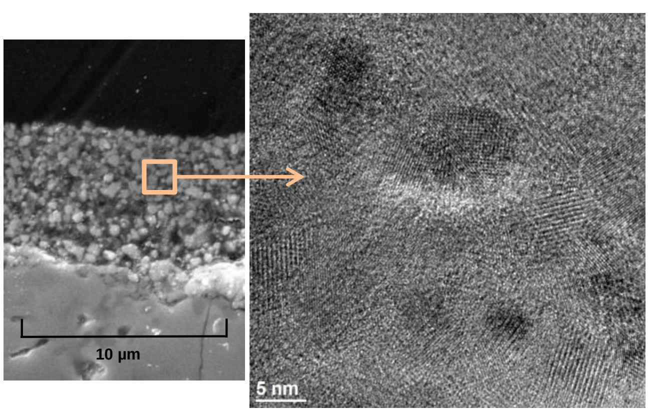

Fig. 1 – Glaze layer in formation at micro and nanoscale. The bulk tribofilm is already nanocrystalline

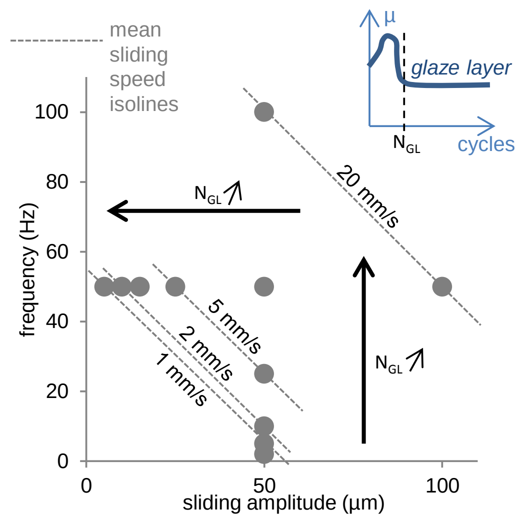

Fig. 2 – Experimental design to evaluate the influence of mean sliding speed on number of cycles necessary to create the glaze layer, N_{GL}

REFERENCES

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