MECHANICAL CHARACTERIZATION OF A TRIBOLAYER CREATED BY HIGH TEMPERATURE FRETTING WEAR IN A CERAMIC/METAL ALLOY CONTACT

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In aeronautics, the blade disk contact, between ceramic and Haynes 25 (cobalt-based alloy) surfaces, is submitted to fretting oscillations, at high temperature, the fretting being an oscillatory movement (at the micrometer order) between two surfaces in contact. This contact has been modeled in the laboratory, showing high friction and wear at temperatures lower than 500°C whereas a sudden decrease of the friction coefficient, and negligible wear is observed above this threshold temperature. The cause of high friction and wear at low temperature was explained in previous paper [1]. At temperatures higher than 500°C, low friction and wear are linked to the formation of a third body, named glaze layer, or tribolayer, this layer being created by compacted and sintered debris, and adhering on both parts, the thickness being between 5-20µm. Its structure and chemical composition was studied in a previous paper [2]. However, understanding the mechanical properties responsible of the glaze layer lubricious properties is still a challenge.

In this presentation, the mechanical properties of the Glaze Layer, measured as a function of the temperature, will be presented, and compared to its tribological properties. The HS25/ceramic fretting contact has been studied, in flat/flat and cross cylinders' configuration, at temperatures higher than 500°C, in order to create the glaze layer. The mechanical characterization of the tribolayer and the HS25 was performed through nanoindentation and in situ SEM microcompression experiments as a function of the temperature, in the temperature domain where the glaze layer is performant and in the temperature domain where friction and wear are important, the tests being performed in the cross section.

The first part of the presentation will be focused on the tribological contacts presentation, and micromechanical devices used description. Then, the glaze layer microstructure, chemical composition and mechanical properties will be detailed and discussed. Finally, a comparison between the mechanical properties and tribological properties of the glaze layer will be detailed [3].

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