MICROMECHANICAL EXPERIMENTS TO EXTRACT MECHANICAL PROPERTIES OF A TRIBOFILM FORMED IN A Ti6Al4V/DLC CONTACT BY FRETTING

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ABSTRACT
Fretting wear of Ti6Al4V versus DLC coating has been investigated \cite{1,2}. It was shown that a tribofilm is formed during fretting. It is mainly composed of oxidized debris of Ti6Al4V, involving a decrease of wear rate and friction.

This study aims at understanding the mechanical properties of the tribofilm responsible of its "lubricating" effect. These mechanical properties have been measured by nanoindentation and by micropillars compression tests. Nanoindentation tests have been performed on the tribofilm, the DLC coating and the titanium alloy. Micropillars have been FIB-machined on the tribofilm and on the titanium substrate. These pillars have been compressed with a diamond flat punch, using an \textit{in situ} Alemnis indenter, installed in a SEM, in order to extract their mechanical behavior (fig. 1).

The results revealed that the tribofilm Young’s modulus, hardness, and Yield stress are higher than the ones from the titanium alloy. Consequently, these high properties could be responsible of the good tribological properties of the tribofilm. Surprisingly, the hardness, calculated from the yield stress obtained by micropillar compression, is higher than the one measured by nanoindentation. It was shown there is no substrate influence on hardness measured using \textit{y} micropillar compression, which is the case by nanoindentation.

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