Tribology under severe conditions at LEM3: an overview of the researches of the TCR group

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Friction in mechanical devices is the cause of decreased performance, increased energy consumption, wear, damage, reduced life and reliability issues. Aerospace and defence systems operate usually under severe environmental conditions, which makes friction problems even more serious. The design of mechanical devices in these systems is very difficult and tribological factors such as friction and wear become really important during the design process. For example, in case of exceptional events such as birds or ice ingestion during the aircraft operation, the running engine may undergo to severe contacts between its rotating blades and the fixed casing leading to possible damage and catastrophic failure of these main components. These contacts lead to conditions of high temperatures, stresses and deformation rates that make analysis, modelling and simulation particularly delicate. The knowledge of the complex thermomechanical phenomena at the blade/carter contact interfaces occurring at high speeds permits to develop adapted strategies in order to reduce the wear of the engine parts.

The "*Thermo-mecanique du contact rapide*" group (the TCR group) of the T-PRIOM department deals essentially with the thermomechanics of sliding surfaces under dry conditions or the process of material removal with a cutting tool or by abrasion at very high speed. Low speed friction processes are also studied but in the case of very high temperature or pressure. We develop novel dynamic experimental methods to characterize the mechanical behaviour of materials at intermediate to high strain rates. The main tools we use are two light gas gun to lunch projectiles at speeds up to 300 m/s and high-speed camera with speeds up to $1x10^6$ frames per second. We also have Kolsky bars (split Hopkinson pressure bars) to conduct dynamic experiments on a variety of materials as a function of temperature. The materials we investigate range from metals, composites, geo-materials and abradables.

In this talk I will outline the researches in Dynamic Failure Mechanics and Tribology of the TCR group. An overview of our experimental facilities and the subject of our PhD thesis and researches and our academic and engineering staff will be presented.