Polymer surfaces rheology subjected to friction generated thermal effect.

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The mechanical responses of polymers, both thermoplastics, thermosets, is hugely dependent on temperature as it can vary over several decades in the vicinity of a transition (T_α, T_β, etc.). Studying the sliding contact between two surfaces at high speed generates frictional heating. This effect can therefore have a great influence on interfacial shearing mechanisms and contact stress as materials transitions are crossed.

The aim of this thesis work is to focus on the influence of the polymer structure (thermoplastics, thermosetting) when crossing a transition, Tα in particular. This work will aim to understand these material structure-tribological properties relationships, in particular the influence of the degree of cross-linking of elastomers on tribological behaviour:

- is there a "liquid/viscous" zone process in the event of a significant rise in the frictional contact temperature for test temperatures below Tα? And what is its thickness?
- does it depend on the degree of cross-linking?
- in the case of thermoplastics, does the existence of a process zone limit the rise in temperature generated by friction? By imposing a upond value threshold on the interfacial shear stress?
- what is the topography of a surface after being heated by a flash of temperature from a sliding contact?

In the team, home-made specific set-ups (high-speed friction device with temperature measurement, micro-scratch apparatus, dynamic JKR...) which control environmental conditions (temperature, relative humidity) allow to observe in situ the contact evolution with all input parameters.

The work on the project will consist on:

- the experimental study of the effect of thermal contact on mechanical behavior for model thermoplastics and elastomers surfaces at the vicinity of microstructure transitions;
- the development of a contact thermal model adapted to the test conditions.
- the development of a specific simulation that will help to build an analysis of the interfacial mechanisms depending on the type of polymers.

The candidate should be a physicist or have a good background in material sciences. The candidate interests should have strong will to balance between experimental tests and numerical simulations.