Tribological behavior of
fatty amines and derivatives compounds

(18 months postdoctoral job)

In the current context of the automotive industry, the control of friction in the engine and transmission components is a major issue. Different families of friction modifiers are used for this purpose, ranging from organometallic compounds such as MoDTC (molybdenum dithiocarbamate) to a wide variety of organic compounds (alcohol, acid, carboxylate, amine, amide, etc ...) commonly named **"Organic Friction modifiers" (OFM)**.

The objective of this postgraduate study is to clarify the action mechanisms of different **fatty amines molecules and derivative compounds**. In literature, the friction behavior of primary amines with alkyl chains containing 12 to 18 carbons demonstrates that these molecules are adsorbed in smaller amounts on steel surfaces than equivalent fatty acids. However the nature of their interaction with the substrate is not clearly understood. Little work has been done on more complex molecules like secondary, tertiary amines, with various different functional groups (ethoxylated amines, salts ...) and with different numbers of functional groups. When the amine is mixed with zinc dithiophosphate (ZnDTP) in oil, strong interactions have been identified, modifying the tribological behavior of the amine.

During the 18 months postdoctoral job, it will be studied:

- the **adsorption mechanisms** of amine molecules on a steel substrate (iron oxide): nature of the interaction and amount of adsorbed molecules.
- the **friction behavior** of these molecules and to understand the link with the composition of the films formed during friction.
- the **interaction** between different OFM and OFM-ZnDTP interaction including their impact on the friction behavior.

To achieve these aims, several experimental tools will be used to characterize in a first step the tribological behavior of these molecules, and then characterize the formed tribofilms from a physico-chemical (XPS and IR) and morphological (AFM) point of view and from a quantitative point of view in terms of adsorbed molecules (quartz balance QCM). It could also be envisaged to carry out some additional analysis by using a synchrotron beamline.

The candidate should have a profile in 'physical chemistry of materials' and some experience in at least one of the above techniques.

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