Master's internship proposal

Tribology of Bulk Metallic Glasses

Working environment

The trainee will work at the **Department of Applied Mechanics of the Femto-ST Institute in Besançon (France)**, and more particularly within the **"Tribology, Functionalization and Characterization of Surfaces"** group (TFCS). This research group is composed of researchers, engineers and PhD students who are specialists in tribology (study of friction, lubrication, and wear). The TFCS group has extensive expertise in the study of the **tribological behaviour** of all types of materials related to a wide range of industrial applications. Our team has **numerous surface characterization tools**, and **various custom-made experimental devices** (named tribometers) dedicated to the study of friction and wear.

Background

Bulk metallic glasses (BMGs) are new materials obtained by an innovative manufacturing process that allows a mixture of metal powders initially heated to above its melting temperature to be cooled at very high speed. The result is a non-crystalline metallic alloy with **exceptional mechanical properties** compared to conventional crystalline alloys: extremely high yield strength, high hardness, high deformation capacity, high fatigue strength... As a result, BMGs are very promising materials for a wide range of high-tech applications. Nevertheless, the use of these materials is still limited on an industrial scale because **their frictional behaviour remains poorly known and unreliable**. The TFCS group is studying the tribological performance of BMGs through experimental tests in close collaboration with **Vulkam**, the unique european company producing BMGs of various compositions in series. The trainee will reinforce the project team associated with this study in the framework of the **TriboRAMA project** beginning on February 2020.

Goals and tasks

The trainee will conduct **sliding and rolling friction tests** using 2 instrumented tribometers. These tests will be carried out on various BMG compositions and by varying **contact conditions** (pressure, sliding/rolling speed, and environment). Following these tests, the trainee will:

- **Characterize the frictional response** of the different materials through the post-processing of the data acquired during tests using Matlab scripts and a custom-made software.
- **Characterize friction-induced surface modifications** (wear, damage, structural and physicochemical changes) using various techniques (SEM, DRX, 3D roughness, XPS…etc).

The objective will be **to quantify the tribological performance of BMGs** according to various contact conditions.

Benefit for the trainee

This mission will allow the trainee to acquire skills in **material science, mechanics, experimental testing, surface characterization techniques, data acquisition and post-processing**. These are highly valued R&D skills. If the trainee wishes to pursue a research career, a **PhD on the same theme** will also be possible within the TriboRAMA project.

Skills

Ability to work in project mode — Precision and accuracy — Taste for experimentation — Ability to report on the work done — Autonomy and initiative — Motivation and enthusiasm — Working knowledge of English

Further information

- Applications should be sent by e-mail to Dr. Pierre-Henri CORNUAULT: pierre-henri.cornuault@ens2m.fr
- Duration: 5 to 6 months. The starting date (~ beginning of February 2019) will be defined with the trainee.
- Salary: about 570 € / month.

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