

**Proposal of training course for Master 2
Scholar year 2008/2009**

Erasmus research training stay at Ecole Centrale Paris (laboratory LGPM)

Laboratory “LGPM”:

The laboratory "Chemical and Materials Engineering" (Laboratoire Génie des Procédés et Matériaux : LGPM) of Ecole Centrale Paris (ECP), has a large part of its research activities in the field of Physico-chemistry of Surfaces and Interfaces. The development of functional surfaces, the characterization and improvement of their properties is one major centre of interest.

The research team "Mechano-chemical behaviour of surfaces – Tribocorrosion), working in this field, has developed their expertise in the study of corrosion and tribocorrosion (combined effects of corrosion and friction on functionalities, damaging and wear of surfaces). For developing such research activities, a pluridisciplinary (chemistry, electrochemistry, materials science) and multiscale (from micro- or nano to macroscopic scale) approach is implemented, involving suitable techniques for characterizing the surface properties and testing methods to study their behaviour and the physicochemical and mechanical processes.

Training course title: *Tribocorrosion of orthodontic Ni-Ti alloys*

Hosting laboratory:

- Laboratoire de Génie des Procédés et Matériaux - Ecole Centrale Paris (Chemical and Materials Engineering Laboratory – Central School Paris)
Grande Voie des Vignes – F 92295 Châtenay-Malabry Cedex

- Laboratoire Multi-matériaux et Interfaces (Multi-material and Interfaces Laboratory),
UMR CNRS 5615. Bâtiment Berthollet - 3ème étage - Université Claude Bernard Lyon1-
43 Boulevard du 11 Novembre 1918 – F 69622 Villeurbanne Cedex

Responsible of training course: Pierre Ponthiaux

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Subject of the Course

The discovery of the shape memory effect and super-elasticity of nickel-titan alloys (NiTi) introduces interesting perspectives in the medical field, especially in orthopaedics and dento-maxillofacial domains.

The principle of the orthodontic treatment is to make teeth move continually in slow displacement by applying controlled forces between fixed brackets on teeth and the arch wire using anchorage points which may be probably endosteal.

The resistance of the friction between the braces and the wire influences critically the quality of the treatment results. From one hand, a very high resistance to friction produces an overload that may damage the surrounding tissues and leads to many clinical complications. From the other hand, the friction induces wear and/or corrosion of materials, especially, in the wire which is often made of nickel-titan alloy and may lead to toxic elemental release of nickel in the body.

In scientific literature it was showed that most studies concerning this problematic were conducted in static conditions without considering the perturbations that may be micro-induced by the

mastication and/or the salivary oral medium. Moreover, these researches take rarely in consideration the impact of bacterial medium which is a determinant element in the oral environment.

The objectives of the proposed training course are the following:

The goal of the project is to develop new approaches providing appropriate information to characterise and optimize the choice of materials and its surface treatment to preserve small friction coefficients and low wear in the contact “bracket-wire” of the orthodontic appliance.

The experimental work would be done by steps:

- Study of the tribologic damage in salivary medium,
- Research on the possibility of anticorrosion and lubrication recovering
- Evaluation of the proposed modifications.

Is the subject fit for hosting an ERASMUS student: YES

Possibility to work towards PhD dissertation: Yes

According to the progression of the work, *in vivo* studies could be done then after *These research subjects are proposed for "Master after Master" level students, with initial training in the field of Materials Science. A knowledge in the field electrochemistry would be also helpful.*

Duration: 6 months from February to the end of July 2009.

The students interested in an Erasmus research stay at ECP will send a detailed CV and an overview of the records by e-mail before the end of December 2008 to the following address:

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