CT2M
Center for Mechanical and Materials Technologies

Scientific Interaction Meetings

Meeting nº 1

2007.10.26 – 14-15h

Room: EC2.31

Agenda:

14h – Ana Catarina Vieira, Age-hardening of functionally graded Al alloy – SiCp composites

14h30 – Júlio Souza, Corrosion behavior of titanium for dental applications in fluoride-containing artificial saliva

Who are we? What are we doing? Which are the main scientific achievements of our work? Which difficulties are we facing during the development of our scientific work?

These are some of the questions we hope to give answers during this series of Scientific Interaction Meetings (SIM). By joining together most of the CT2M´s researchers in a regular basis (every two weeks), this SIM cycle is also expected to contribute to the promotion of further joint research actions involving different research groups.

SIM will be organised by Mathew T. Mathew and Luís A. Rocha. In each session (1h) two talks will be delivered by researchers belonging, preferentially, to two different CT2M´s research groups. Each presentation will take 20 minutes, and 10 minutes will be reserved for discussion.

In the first SIMeeting the following works will be presented:

Ana Catarina Vieira

Age-hardening of functionally graded Al alloy – SiCp composites

Al/SiCp and, in particular, functionally graded Al/SiCp composites (FGMMC´S) have shown a great potential for industrial applications in the aerospace and automotive industries. The main advantage arises from the combination of a high wear resistance up to relatively high temperatures, provided by the incorporation of the ceramic particles, and a good bulk toughness, which is obtained by the selective reinforcement of the superficial region of the component. These composite materials are produced by conventional liquid metallurgy processes (stir and centrifugal casting), the properties of the produced components being those resulting from this processing route. By adjusting the chemical composition of the Al-alloy matrix, it is possible to combine enough castability with heat treatment capability.

Therefore, it becomes possible to perform post-processing age-hardening heat treatments, which will provide a wider range of properties to the final component. Age-hardening originates nano-scaled precipitates which can improve the hardness and toughness of the material. An unknown issue is the influence of the presence of the SiC particles, and particularly of the SiC/Al-alloy interface on the precipitation sequence in these materials.

The main aim of this project is to investigate the effect of age-hardening on the properties and micro and nano structure of functionally graded Al/SiCp composites. Also, as in many practical situations, functionally graded Al/SiCp composites will be in conditions that combine chemical and mechanical degradation (tribocorrosion), particular focus will be given to the investigation of the influence of age-hardening on the tribocorrosion behavior of these materials.

Júlio Souza

Corrosion behavior of titanium for dental applications in fluoride-containing artificial saliva

The increase in the use of titanium-based implants has called the dentists and researchers attention due their properties as low density, high mechanical resistance, corrosion resistance and biocompatibility. However, there are not many studies about the corrosion resistance of titanium and its alloys in different oral simulating environments. The oral environment may present different pH values and variable concentrations of corrosive substances. Oral local environment depends on the oral hygiene, patient diet as well as intrinsic factors of the organism (saliva flow, dental biofilms, patient general health state, etc.). The objective of this work is to investigate the mechanisms of degradation of commercially pure (c.p.) titanium and of the Ti6Al4V alloy in artificial saliva solutions. Samples were cut from Ti6Al4V and c.p.. Ti grade II bars (10x25mm) and were wet-ground on SiC abrasive papers to 1200 mesh. Electrochemical tests were carried out at 37oC in Fusayama´s artificial saliva containing 30 and 12300 ppmF-. Tests consisted in the monitoring of the open-circuit potential (OCP), followed by potentiodynamic polarization tests. Also, electrochemical impedance spectroscopy (EIS) tests were performed in order to evaluate the evolution of the surface of the materials upon immersion in the solution. After being tested, the surfaces of the materials were analyzed by, scanning electronic microscopy (SEM) coupled to energy dispersive spectroscopy (EDS) and atomic force microscopy (AFM). Tribocorrosion tests are being carried out in fluoride solutions to evaluate the synergism of the combined physico-chemical-mechanical interactions on the degradation of the materials.