TF Symposium:
"Corrosion prediction for medical implants and devices"

The electrochemical reactivity of metals and alloys in physiological environments of the human body poses scientific/technological challenges for a broad range of biomedical applications, such as metallic implants, sensing components and medical instruments. In particular, degradation of metallic implants is often accelerated in confined geometries (e.g. crevices), as well as under dynamic loading where corrosive attack cannot be tolerated and should be mitigated to avoid early failure. Other less documented examples are intoxication and inflammation induced by metallic ion leaching and/or abrasion related to degradation of the medical implants or loss of devices functionality. Also the advent of biodegradable materials impose new challenges: while corrosion is desired for absorption of the implant, its rate and homogeneity needs to be tightly controlled for optimal healing of the damaged tissue, and avoid premature mechanical failure. Accurate experimental corrosion predication of these materials for vastly different environments (tissue types, patient age and health) is essential.

This workshop addresses the main materials, microstructural and geometrical design challenges in medical implants/devices with a focus on fundamental understanding and better prediction through advanced *in-vitro* characterization of the underlying corrosion phenomena.

Contributions (also from clinicians and biologist) in the following topical areas are especially welcomed:

- Development of advanced in-vitro setup for accurate corrosion prediction
    - Integration of relevant biological environments

- Permanent metallic implant degradation, including issues related to particle/ionic release (linked to join session on degradation of orthopaedic joint implants with WP18)
    - Localized, crevice and fatigue corrosion mechanisms
    - Corrosion processes at joined (brazed/welded) and/or multimaterial interfaces

- Biodegradable metallic or composite implants
    - *in vitro* and *in vivo* degradation mechanisms; origins behind discrepancies
    - Surface treatments for temporary initial corrosion protection

- Personalized implants
    - Corrosion mechanisms of additive manufactured (AM) and laser-structured implants
    - Modulated corrosion phenomena due to patient's illness/condition, implantation site, specific implant surface functionalization and/or coatings

- Implanted devices and sensors lifetime in contact with physiological environments

- Medical instruments
    - Passivation, labelling and new sterilization/cleaning requirements

A more detailed understanding of the corrosion mechanisms is needed to achieve realistic lifetime corrosion **predictions** and to perform accurate risk and health assessments of existing and novel implant/device technologies. The final aim is patient safety/comfort improvement and to provide expert support to industry for patient-tailored implant/device design and reduce the increasing trouble shooting activities observed in recent years.

Chairman: Dr. Patrik Schmutz, Empa Materials Science and Technology, Dübendorf, Switzerland.

Co-organizers:

Dr. Sviatlana Lamaka, Helmoltz-Zentrum Hereon, Geesthacht, Germany

Prof. Iris De Graeve, Vrije Universiteit Brussel, Belgium

Dr. Martina Cihova, Empa Materials Science and Technology, Dübendorf, Switzerland

Expected duration: 1-2 days

Expected audience: 50 - 60 attendees