Title: **Nanocoatings of inorganic surfaces by the layer by layer (LbL) technology**

The aim of Biocoat project (PPP, RW) is to develop new functionalities with high added value on inorganic substrates through multifunctional molecular coatings following a multidisciplinary biomimetic approach

The concept of molecular biomimetic led to the design and synthesis of macromolecules that learn both from nature and from organic chemistry for multifunctional properties amongst others adherence or at the reverse anti-adhesion.

Layer by layer process (LbL) is a simple and convenient way of making multilayered films of thicknesses ranging in the nano-scale with tailored composition and architecture. Thin multilayer films can be easily built in aqueous solution on a wide variety of inorganic surfaces being flat or particulate, by dipping or spraying process. The driving force for self assembly of polyelectrolyte films is electrostatic interactions.
First, a polyelectrolyte is adsorbed onto target charged substrate then alternatively polycationic and polyanionic components are deposited.

Examples of polyelectrolytes are water soluble multi-charged synthetic polymers, possibly designed by molecular biomimetic, proteins, polysaccharides, etc.

Physico chemical properties of the film can be adjusted by varying the nature of the constitutive polyelectrolytes, their charge density, the pH and ionic strength of aqueous solutions.
Stability of multilayered films depends on charge density of multi-charged constituents, hence on ionic strength. Durability may be brought by crosslinking the film by chemical or physical means.
LbL technique shows several advantages:

- The making process is environmental friendly, adaptable to industrial making process, easily automated using a dipping or spraying robot, not impacted by substrate shape.
- Films can demonstrate specific properties (electrical, optical, etc …) and desirable functions by inserting adequate active molecules. Nano-multilayered films can be functionalized with biomolecules, or doped with drugs, with inorganic or organic particles, to confer to the substrate unique properties or allow for controlled, delayed delivery of active ingredients.

This technology could lead to the development of surfaces with (anti)-adhesion properties towards proteins or microorganisms, with improved cleanability, hygiene, biocompatibilty etc, and therefore applications in biomedical field (drug delivery, basis for tissue reconstruction,etc), food industry, and many others.

Authors: E. FAURE, G. ZOCCHI, S. LENOIR, C. VREULS, G. GARITTE, F. FARINA, C. DETREMBLEUR, C. ARCHAMBEAU, C. VAN DE WEERDT (Université de Liège: BMGG-CERM; ArcelorMittal Research Liège)

Director: J. MARTIAL: J.Martial@ulg.ac.be

Bibliography

G. Decher, Layered Nanoarchitectures via Directed Assembly of Anionic and Cationic Molecules, in: Comprehensive Supramolecular Chemistry, Vol. 9, "Templating, Self-Assembly and Self-Organization", J.-P. Sauvage and M.W. Hosseini (eds.), Pergamon Press, Oxford, 1996, 507-528

G. Decher, Fuzzy Nanoassemblies: Toward Layered Polymeric Multicomposites. *Science* **277**, 1232-1237 (1997)

Voegel, J.-C. Decher, G. Schaaf, P. Multicouches de polyelectrolytes dans le domaine des biotechnologies. ACTUALITE CHIMIQUE. 2003, PART 11/12, pages 30-38

Aurélia Charlot, Valérie Sciannaméa, Sandrine Lenoir, Emilie Faure, Robert Jérôme, Christine Jérôme, Cécile Van De Weerdt, Joseph Martial, Catherine Archambeau, Nicolas Willet, Anne-Sophie Duwez, Charles-André Fustin, Christophe Detrembleur . "All-in-one strategy for the fabrication of antimicrobial biomimetic films on stainless steel"
Submitted in Journal of Materials Chemistry