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IMCN SEMINAR

«Applications for functionalized polyoxometalates»

Friday 23 June 2017 – 11:00 am
LAVO 51
Place L. Pasteur, Louvain-La-Neuve

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ABSTRACT
Professor Bernold HASENKNOPF

We have developed over the last decade several synthetic approaches for functionalizing POMs with organic molecules, and for performing organic reactions on grafted ligands. The interplay between these inorganic metal-oxide clusters and organic molecules diversifies their properties and applications. This presentation will give an introduction into this rich polyoxometalate chemistry, and then focus on three examples of uses of organically functionalized POMs:

- The combination of POMs with polymers – either obtained by grafting polymer chains or by polymerization from grafted initiator – gives rise to smart materials.[1,2]
- The grafting of organocatalysts onto chiral, enantiomerically pure POM, yields a chiral catalyst. The chiral information can be transferred from the inorganic framework to organic substrates in an enatioselective reaction.[3]
- A POM bio-functionalized with a DNA primer was successfully used in a PCR protocol, the POM-DNA hybrid was annealed to electrode surface bound DNA, and detected by electrochemistry. This opens the way to electrochemical DNA sequencing.[4]

For each case, the synthetic and analytical challenges that were solved are also presented.

Left: Chirality transfer from oxide surface to organics. Right: POM-DNA hybrid annealed to surface bound DNA as electrochemically active label for DNA detection.


BIOGRAPHY
Bernold Hasenknopf studied chemistry in Germany, France and Great Britain, and obtained his Ph. D. in 1996 under the supervision of Jean-Marie Lehn at the University of Strasbourg for his work on circular helicates. He then joined the group of Peter Schultz in Berkeley for one year to work on unnatural biopolymers and catalytic antibodies. In 1997, he became faculty member of the University Pierre and Marie Curie (UPMC) in Paris where he is full professor now. His research interests focus on supramolecular chemistry of multimetallic assemblies, and their interactions with biomolecules. In a very close and fruitful collaboration with Serge Thorimbert and Emmanuel Lacôte over more than ten years, he developed methods for organic post-functionalization of polyoxometalates.

Key results are the rational enantiomeric resolution of a polyoxometalate, and the transfer of chirality from the inorganic metal-oxygen framework to organic molecules. He also investigated together with Claude Cochet polyoxometalates as enzyme inhibitors, and established very efficient inhibition of the human kinase CK2. In 2009, he founded a group for supramolecular chemistry at the "Institut Parisien de Chimie Moléculaire" of UPMC which is now part of the group "Glycocchimie organique, biologique et chimie supramoléulaire". His current projects concern the assembly of polyoxometalates, DNA-polyoxometalate hybrids in view of DNA sequencing, cyclodextrin-polyrotaxanes for bimodal imaging and switchable magnetic tweezers.

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