“Molecular approaches towards Organic-Inorganic Hybrid and Nanostructured Metal Oxide Materials for Gas Sensing, Photovoltaic and Photocatalysis Applications”

Presented by:

Dr. Thierry Toupance

University of Bordeaux

16th Zimmer International Scholar

Departmental Colloquium

Monday, April 2, 2018
Program begins: 3:30 p.m.
601 Old Chem
Thierry Toupance

Thierry Toupance was born in 1967 near Paris (France). He obtained a Diplôme d'Ingénieur from the Ecole Supérieure de Physique et Chimie Industrielle de Paris, where he studied molecular inorganic chemistry and, then, received his PhD in 1995 from the University Pierre et Marie, Paris in Chemistry with distinction and highly commended (Honours Cum Laude). He held several research positions in Paris, Bordeaux and Oxford UK and since 2004 he holds a Professorship position at the University of Bordeaux and presently belongs to the "Institute of Molecular Science" (CNRS UMR 5255). The Thierry Toupance group is focused on the design of new synthetic routes to prepare functional organic-inorganic hybrid materials for various applications such as photocatalysis, gas sensing and photovoltaic conversion. For instance, he has developed research projects over the past decade in the following areas: design and syntheses of sol-gel precursors of nanocrystalline F-doped tin dioxide material and mesoporous tin dioxide materials; modification of oxide surface by organometallic compounds; design and synthesis of new dyes for dye-sensitized solar cells; low-temperature processing of semi-conducting oxide layers for photovoltaic and electrochromic applications; new mixed metal oxide heterostructures for photocatalysis and photovoltaic conversion. He is the co-author of 108 publications (h = 29), 3 chapter of books, and 6 patents and has given 17 invited lectures in international conferences along with 20 seminars in French and foreign universities, and more than 60 presentations in International Scientific Conferences. As far as the teaching activities are concerned, Thierry Toupance is in charge of several lectures at the University of Bordeaux, from the second up to the fifth years of study mainly in the field of synthetic organic and organometallic chemistry, NMR techniques, nanosciences and hybrid materials. Between 2008 and 2012, he was responsible for the Erasmus Mundus FAME Master specialization in the Master of Sciences & Technology & Health of the University of Bordeaux 1. Since 2012, he is at the head of the “Doctoral School in Chemical Sciences” of the University of Bordeaux and he is presently the coordinator of a European Joint Doctorate ITN Programme in the field of functional materials.
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Dr. Thierry TOUPANCE
(Professor at the University of Bordeaux)

Combining at the nanometer scale semi-conducting metal oxide as tin dioxide (SnO₂) or titanium dioxide (TiO₂) with organic functionalities gives rise to functional hybrid materials with promising applications in various fields such as catalysis, sensing, opto-electronics and energy conversion. The fine control of the interface between the organic and the inorganic networks constitutes a key requirement to reach good stabilities and reproducible properties. On the other hand, development of semiconducting metal oxide heterostructures by solution routes led to nanoporous materials showing enhanced photocatalytic properties. In this context, we aim at developing organic-inorganic hybrid systems based on semi-conducting metal oxides, in which strong covalent or iono-covalent linkages exist between both networks, to obtain new functional materials. In parallel, we are also developing metal oxides heterostructures by solution process to obtain nanocatalysts for photocatalysis.

An original molecular route towards functional organotin-based hybrid materials will be first described along with some promising properties in the field of gas sensing. In a second part, different approaches developed in the field of dye-sensitized solar cells (DSCs) will be reported, in particular new porous SnO₂ photoanodes for efficient and stable DSCs, and original dyes compatible with various electrolytes. Finally, metal oxide heterostructures, as RuO₂-TiO₂ or NiO-TiO₂, will be presented and their photocatalytic properties for organics decomposition and methanol reforming will be rationalized.