ChemISTry Colloquia

Understanding Catalysis, One Atom at a Time

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Mondi Seminar Room 2 A+B

Most efficient chemical processes used in industry rely on heterogeneous catalysis. While the search for more sustainable processes and the changes in environmental policies impose the continuous development of more efficient catalysts, we have currently little understanding of the structure of the actives in these processes. Hence, due to their inherent complexity, heterogeneous catalysts have been mostly developed empirically.

Here, we will show how constructing active sites, one atom at a time on surfaces, enables molecular-level understanding and implementation of rational approaches for the improvement of catalytic processes. We will first illustrate how this approach enables to generate selective single-site catalysts. We will next show how from these isolated (single) sites, one can generate and understand far more complex systems such as supported nanoparticles, where interfaces, alloying... play a critical role. This lecture will be developed around these themes and will show how the development of advanced characterization tools augmented by computational approaches can provide useful information to bridge the gap between fundamental and applied (industrial) catalysis.

Prof. Christophe Copéret (CCH) was trained in chemistry and chemical engineering (CPE-Lyon, France) and carried out a PhD with Prof. E.i. Negish (Purdue University), where he investigated the synthesis of complex molecules via Pd-catalyzed carbonylation reactions. After a postdoctoral stay with Prof. K.B. Sharpless (Scripps), CCH entered CNRS in 1998 and was promoted CNRS Director in 2008. Since 2010, CCH has been a Professor in the Department of Chemistry and Applied Biosciences, ETH Zürich, and has been an Associate Editor for JACS since 2022. The scientific interest of CCH lies at the frontiers of molecular, material, and surface chemistry as well as NMR spectroscopy with the aims to understand the electronic structure and design molecularly-defined heterogeneous catalysts.