Secteur des Sciences
et Technologies

Invitation à la soutenance publique de thèse de

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Master bioingénieur : chimie et bio-industries à finalité spécialisée

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« New synthetic approaches to efficient Ti-SiO2 epoxidation catalysts »

qui se déroulera
le jeudi 24 octobre 2019 à 16h15
Auditoire LAVO 51
Place Louis Pasteur, 1
1348 Louvain-la-Neuve

Membres du jury :

Prof. Damien Debecker (UCLouvain), supervisor
Prof. Eric Gaigneaux (UCLouvain), supervisor
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Prof. Michel Devillers (UCLouvain), secretary
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The epoxidation of olefins is a subject of considerable fundamental and industrial interest as epoxides are involved in the manufacture of a wide range of valuable commercial compounds. This reaction is typically catalyzed by heterogeneous Ti–SiO_2 titanosilicates, which were first introduced in the 1970s. Among these catalysts, TS-1 zeolite is industrially used for the production of propylene oxide. Nevertheless, despite its attractive performance, this catalyst is mainly restrained to lower substrates, as bulky molecules cannot access the micropores of the zeolite. Intensive efforts were therefore made in the past decades to develop new titanosilicate catalysts, either amorphous or crystalline, so as to improve the catalytic performance as well as to expand the reaction scope. This thesis tackles challenges that are omnipresent in the current research on solid titanosilicate catalysts.

On the one hand, the intricate relation between the physico-chemical properties and the catalytic performance is highlighted. New titanosilicates prepared by atypical sol-gel techniques (non-hydrolytic sol-gel, aerosol-assisted sol-gel, direct emulsion templating, dry gel conversion) are investigated, with a particular focus on selected physico-chemical properties, namely the surface functionality, the texture and pore architecture, and the macroscopic morphology. Each catalyst is characterized in details and its catalytic performance is evaluated under specific reaction conditions and compared to the benchmark TS-1 catalyst.

Even though hydrogen peroxide is an attractive oxidant for the green epoxidation of olefins, its current industrial production raises some questions. Therefore, on the second hand, the chemo-enzymatic production of epoxides with *in situ* enzymatic production of H_2O_2 is investigated. Exploiting the spray-drying technique, TS-1 crystals are assembled into hollow microstructures that can accommodate large amounts of enzymes on a single solid. Upon optimization of the operating conditions, this controlled design is shown to be effective for chemo-enzymatic epoxidation and also appears as a promising way to develop new multifunctional materials.