Secteur des Sciences et Technologies

Invitation à la soutenance publique de thèse de

Monsieur Florent MINETTE

Master ingénieur civil en chimie et science des matériaux

Pour l'obtention du grade de Docteur en sciences de l'ingénieur et technologie

« Multi-scale modeling and design of a structured catalytic reactor for bi-reforming of methane»

qui se déroulera
le lundi 20 mai 2019 à 18h
Auditoire SUD 01
Place Croix du Sud
1348 Louvain-la-Neuve

Membres du jury :

Prof. Juray De Wilde (UCLouvain), promoteur
Prof. Hervé Jeanmart (UCLouvain), président
Prof. Joris Proost (UCLouvain), secrétaire
Prof. Eric Gaigneaux (UCLouvain)
Dr. Jan Verstraete (IFP – en, France)
Prof. Guy Marin (Ugent, Belgique)

UCLouvain

Methane reforming is the most widely practiced process for the production of hydrogen and syngas. The process is however strongly limited by heat transfer between the furnace and the process gas, pressure drop and intra-particle diffusion limitations. Structured catalytic reactors are promising in order to intensify the process and deal with the limitations encountered in conventional reformers.
The multi-scale modeling of ZoneFlow™ structured catalytic reactors is addressed. The intrinsic reaction kinetics is experimentally studied in a micro-packed bed reactor. The Langmuir-Hinshelwood-Hougen-Watson-type rate equations are derived and non-linear regression is applied to estimate the rate parameters. A pseudo-continuum approach description of the catalyst coating is used to account for intra-catalyst diffusion limitations. The complex flow pattern is described by means of Computational Fluid Dynamics (CFD). To bridge the scales of turbulence, the RANS approach is adopted and the *k*-ε turbulence model is applied. Thermal conduction and radiative heat transfer are included. The reactor model is validated using specific experiments including cold flow pressure drop, inert heat transfer and pilot plant tests under reactive conditions.
The developed reactor model is then used to study and optimize the performance of ZoneFlow™ reactors under commercial operating conditions.