Lunedì 14 Novembre 2022 alle ore **11:30** presso **l'aula G**

il **Prof. Tapio Salmi**

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terrà il seminario dal titolo:

Towards new structures and reactors in catalysis

La presenza della S. V. sarà molto gradita

Paolo Centomo

Il Direttore del Dipartimento
Michele Maggini

The classical approach to perform catalytic two- and three-phase processess is based on the use of slurry reactors or catalytic packed beds. Slurry technology implies that small (less than 100 micrometer) catalyst particles are dispersed in the liquid phase, and reactive gas is continuously added to the system. The liquid phase is typically in batch. The benefit of this technology is the possibility to operate in the domain of intrinsic kinetics, because the mass transfer resistances are eliminated by vigorous stirring and small particle sizes. The disadvantages are the limitation to (semi)batch technology and eventual catalyst separation problems. Conventional fixed beds enable continuous operation, but the catalyst particle size is limited by increasing pressure drop as the particle size is diminished. Therefore, large catalyst particles are preferred, which leads to heavy internal mass transfer limitations in the pores of the particles and low effectiveness factors, because the internal parts of the particles remain in a passive state.
The way out from this dilemma is provided by structured catalysts and structured reactor systems which are under a very intensive development. Typical examples of structured systems are catalytic monoliths, solid foams, 3D printed systems as well as milli- and microreactor systems. All these innovations enable to combine the benefits of slurry and classical packed bed technologies: the catalyst layers are thin, enabling continuous operation in the domain of intrinsic kinetics and the open structures in the new systems keep the pressure drop well under control. The result is a dramatic improvement of the performance compared to conventional technology, fulfilling the principles of process intensification.
The success of the microreactor technologies and solid foams are illustrated by three case studies: production of sugar alcohols (sweeterers) by hydrogenation, chloroalkanes (chemical intermediates) by hydrochlorination and aldehydes (chemical intermediates) by oxidation. The active catalytic metals (Ru and gold) were deposied on the carrier materials (active carbon and alumina) and the solid foams and microreactor channels were coated with the catalyst materials. Very precise kinetic experiments were carried out and the data were modelled with rate equations based on plausible surface reaction mechanisms. The models gave an excellent description of the experimentally recorded kinetics. The superiority of the new technology was further illustrated with comparative numerical simulations of the concentration profiles in catalyst layers with different thicknesses: a 10-fold improvement of the process performance was obtained in the best cases. Structured catalysts and microreactors are strong tools in catalyst development, kinetic investigations and process intensification.

The lecturer, Dr Tapio Salmi is professor in chemical reaction engineering at Åbo Akademi, Finland. He has the highest research position in Finland , Academy Professor. He is the author and co-author of 640 scientific articles, four textbooks and he has supervised more than 60 doctoral theses in the field of chemical reaction engineering and catalysis.