VAALBIO team - Valorization of alkanes and biomass

RESEARCH THEMES
Innovation in catalysis for biorefineries

The scientific developments of the VAALBIO team are focused on the valorisation of two types of substrates, namely the bio-based ones (renewable resources) and the petro-sourced ones (limited resources of which we optimize the use). We integrate the development of catalytic formulations with relevant process & reactor engineering. We have a particularly strong activity in the field of biorefineries design, but our expertise also allows us to contribute to other issues such as biogas or shale gas valorisation, for example, which are products with a dramatically increasing availability.

An integrated approach in catalysis. In each of its research projects, the VAALBIO team relies on its skills in synthetic chemistry and in characterization techniques essential to the elaboration of catalytic formulations and to the understanding of their action under working conditions. We also possess skills in engineering of catalytic reactors, which allows us to take into account from the early stage of each new research project the gold triangle reaction/catalyst/reactor. For instance, in the case of exothermic reactions of selective oxidation of light hydrocarbons, the use of structured reactors, more adequate to evacuate heat fluxes, enables a better control of the reaction selectivity. Another example is the development of a 2 zones fluidized bed reactor enabling in the same unit both the glycerol dehydration reaction and the regeneration of the coked catalyst.

In addition, our fast screening REALCAT platform (www.realcat.fr), which is unique in the world, enables a considerable shortening of the trial-and-error phase necessary to design new catalysts formulations. Finally, we handle process intensification for the development of sustainable processes with optimization of material and energy resources.

A particularly strong activity for the development of biorefineries. The development of biorefinery processes is of the upmost importance for the establishment of an economy based on bio-resources. Within this frame, like it is already the case in a petro-refinery, catalysis occupies a key role. However, unlike petro-resources of which the variations in nature and composition are relatively limited, the
team ‘bio-resources’ represents a large variety of compounds (cellulose, hemicellulose, vegetable oils, lignin, etc.). A set of specific technologies must therefore be elaborated to rationally convert, purify and refine each fraction. In this context, the VAALBIO team develops many catalytic technologies for the conversion of platform molecules issued from biomass, mainly to generate chemical intermediates such as solvents or monomers, but also for energy-driven applications, with, for example, a particularly important effort for the production of bio-sourced hydrogen.

TEAMS FLAGSHIP PROJECTS

In addition to numerous industrial partnerships, the VAALBIO team has achieved major successes that have backed up a fast expansion. These include the coordination of the FP7 EuroBioRef European project with a total budget of € 38 million (30 partners) and the participation to the ITE IFMAS (110 M€) as well as the ITE PIVERT (€ 247 million) in which we are responsible for the “catalysis and biocatalysis” part. Such large-scale actions also benefit from the EQUIPEX REALCAT (high-throughput screening platform), also obtained by the VAALBIO team, with a budget of € 9.4 million. The team also uses a new demonstration facility, the Catalysis Pilot Hall of UCCS.

At the International level, UCCS has been appointed as the “mirror” site of the International Joint Unit CNRS / Solvay in Shanghai, the "Eco-Efficient Products and Processes Laboratory" (E2P2L, CNRS UMI 3464), in February 2013. Furthermore, VAALBIO team has numerous international collaborations worldwide. In particular, it is the animator of the «Environment» axis of a international associated laboratory (LIA) between France and Brazil called «Energy and Environment» and is coordinating the French-Japanese LIA NANOXCAT.