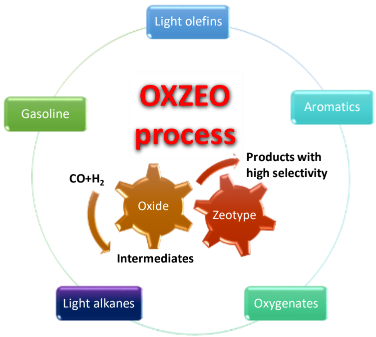
PhD thesis proposal-University Claude Bernard Lyon 1
PEPR B-Best-Optifuel

Ircelyon
INSTITUT DE RECHERCHES SUR LA CATALYSE ET L'ENVIRONNEMENT

The OX-ZEO process to selectively convert biosyngas to jet fuels or petrochemical hydrocarbons

The transformation of biomass into fuels and chemicals is becoming increasingly popular, worldwide, to mitigate global warming and diversify energy sources. One way is to deconstruct it into syngas (a mixture of carbon monoxide, carbon dioxide and hydrogen) and then convert it into synthetic fuel or lubricant via Fischer-Tropsch (FT) synthesis. This route has many drawbacks (selectivity, numerous successive steps…) which increases the global cost of the process. Recently, a new technology, called OX-ZEO process, has been proposed for the direct conversion of syngas into other more valuable products.



This process combines a hydrogenating metal oxide to produce an intermediate (methanol or ketene) which is converted inside the micropores of an acidic zeotype. Numerous OX-ZEO combinations have been investigated and the versatility of the process has been demonstrated to selectively and stably produce light olefins, aromatics or fuels.[1,2] Selectivity mostly relies on the choice of the zeotype, whose micropore size leads to shape selectivity. However, its global topology (porosity structure, crystal size) and its acidity was shown to also influence selectivity[1,2] and hence a precise control of such properties by a rational design at different scales is key. The major limitations of the OX-ZEO process are its low productivity due to the need to limit hydrogenation of the products over the oxide and high CO_2 selectivity due to the water-gas shift reaction.

Therefore, the main objective of this PhD thesis is to determine the key parameters to synthesize more active and very selective oxide-zeotype bifunctional catalysts for the conversion of biosyngas to jet fuel and/or valuable petrochemical hydrocarbons like BTX aromatics and in fine propose new formulations. For that purpose, a methodology based on the rational design of mixed oxides, different zeotypes, their detailed characterization including *in situ/operando* measurements and catalytic evaluation to establish structure-catalytic properties relationships will be used.

This work will be achieved at IRCELYON within the framework of the Optifuel project of the PEPR B-Best (Biomass, biotechnologies, technologies for green chemistry and renewable energies) in collaboration with IFPEN. The funding is already obtained.

Starting date: 01 september 2024
Net salary: 1720 euros/month
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- IFPEN promotors: Sylvie Maury and Nicolas Cadran

For application, please send **C.V., Motivation and recommendation letters, M1 and M2 scores**.

References

1) W. Zhou, K. Cheng, J. Kang, C. Zhou, V. Subramanian, Q. Zhang, Y. Wang, New horizon in C1 chemistry: breaking the selectivity limitation in transformation of syngas and hydrogenation of CO_2 into hydrocarbon chemicals and fuels, Chem. Soc. Rev., 2019, 48, 3193.
2) X. Pan, F. Jiao, D. Miao, X. Bao, Oxide−zeolite-based composite catalyst concept that enables syngas chemistry beyond Fischer−Tropsch synthesis, Chem. Rev., 2021, 121, 6588.

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