

M2 internship in Catalysis and InfraRed Spectroscopy

Duration: 5 months

Location: IRCELYON/CNRS (Villeurbanne)

Starting date: February till June 2022

Grant : 590 euros/month

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IRCELYON: IRCELYON is the largest CNRS department devoted for fundamental and applied research in Catalysis in France. It offers state of the art facilities as well as cutting-edge tools for the characterization of solid catalysts and adsorbents.

Background: The cost and scarcity of noble metals have led to the need to develop new hydrogenation catalysts based on base metals. Apart from nickel, which is toxic, no other single base metal exhibit sufficient activity or selectivity. In contrast, alloys of base metals have demonstrated promising catalytic properties, in particular formulations based on Fe and Cu. Alloys of these metals will be prepared and tested for the hydrogenation of CO₂ and furfural, which are both of importance for the production of sustainable chemicals.

Work description. A brief literature review will be carried out. Fe- and Cu-based will be prepared according to various published methods. Catalytic data will be carried out in an IR cell that allows collecting kinetic and spectroscopic data simultaneously. The results will be analyzed and kinetic models will be investigated in order to determine structure-activity relationships. Additional structural characterization will be carried out by appropriate techniques (e.g. XRD, SEM, TEM, N₂ physisorption,...).

Educational value: The student will be trained in catalyst synthesis (by Dr E. Marceau), catalytic testing methods (by Dr Y. Schuurman) and Infra-Red spectroscopy (Dr F. Meunier). Practical and theoretical aspects of Catalysis are covered.

Candidates: M1 in Chemistry, Physical-Chemistry or Catalysis.

References:

D. Shi et al.. Bimetallic Fe-Ni/SiO₂ catalysts for furfural hydrogenation: Identification of the interplay between Fe and Ni during deposition-precipitation and thermal treatments. *Catalysis Today*, Elsevier, 2019, 334, pp.162-172

J. Scalbert et al., Rational design of a CO₂-resistant toluene hydrogenation catalyst based on FT-IR spectroscopy studies. *Journal of Catalysis*, Elsevier, 2014, 318, pp.61-66