### Master II internship in zeolite synthesis

**Duration:** 5-6 months  
**Location:** IRCELYON/CNRS, Campus de la DOUA, Villeurbanne.  
**Starting date:** Early 2020  
**Grant:** 570 euros/month  
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**Background:** Zeolites are crystalline microporous materials formed by TO₄ tetrahedra (T= Si, Al, Ge, B...) connected by oxygen atoms and forming channels and cavities of molecular dimensions. Depending on their chemical composition, as well as shape and size of the pores, zeolites can be used in relevant fields such as adsorption, catalysis or ion exchange. The composition of a zeolite framework, in particular the aluminum content, can be varied by changing synthesis conditions (nature of the gel, temperature...). However, those changes have a huge impact on the crystallization and the expected zeolite can be contaminated or totally replaced by undesired structures. A PhD student currently working in collaboration with IFPEN on the direct synthesis of zeolite Y (structure code FAU) with high Si/Al ratios has observed the formation of zeolites that could have a significant interest because of their unusual composition and/or morphology. The aim of the internship will be to assist the PhD student in the optimization of synthesis parameters and the deep characterization of these particular materials.

**Work description.** The student will have to carry out hydrothermal syntheses under the direct supervision of the PhD student. This includes manipulation of chemicals, preparation of gels, recovering of solid phases by filtration and/or centrifugation, calcination. All zeolites will be characterized using appropriate techniques (XRD, SEM, TEM, N₂ physisorption, NMR...) available at IRCELYON. The student will be trained on most of these techniques and one of the objectives of the internship is that he/she becomes independent rapidly. This internship will allow the candidate to acquire a solid formation in the preparation of catalytic materials, especially zeolites, as well as in the characterization of crystalline porous solids. Results and work progress will be regularly evaluated in meetings with supervisors from IRCELYON and IFPEN.

**Educational value:** The student will be trained in zeolite synthesis and characterization methods.

**Candidates:** Student with skills in inorganic chemistry or material synthesis will be appreciated.

**Supervisors**  
Dr Alain TUEL (IRCELYON supervisor, Alain.tuel@ircelyon.univ-lyon1.fr)  
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