

DOCTORAL SCHOOL “ MATERIALS, RADIATION AND ENVIRONMENTAL SCIENCES ” (ED 104)

UNIVERSITY: University of Lille 1, Villeneuve d'Ascq, France.

Scientific domain: « Molécules et matière condensée »

Title of the thesis: “High-sensitivity NMR spectroscopy for the characterization of thin film materials for hydrogen technologies”

Supervisor(s): Pr Olivier Lafon, (olivier.lafon@univ-lille1.fr) & Dr F. Méar (francois.mear@univ-lille1.fr)

Laboratory: Catalysis and Solid State Unit (UCCS), Glasses & NMR methodology.

Research project (international/national/regional) : « Sciences de la matière et des matériaux, énergie »

ABSTRACT

Project: Our research group has recently developed advanced glass thin films with a thickness of tens of nanometers. These thin films are promising for numerous applications, including solid-oxide fuel cells to deliver energy from hydrogen fuel, microbatteries, photovoltaics, aeronautics... Hitherto the structure of silica thin film has been characterized but little is known about the structure of thin film made of multi-component glasses. This project aims at characterizing the atomic-level structure of these advanced materials using innovative characterization techniques. The composition and texture of the thin films will be characterized by transmission electron microscopy and electron tomography. Local structure and connectivities of the glass network will be probed using highly sensitive solid-state NMR methods, including high-field NMR, microcoils and dynamic nuclear polarization (DNP).

Host and research infrastructure: Lille is a vibrant and handsome city, imbued with a rich history, located in the middle of northwestern Europe (only 30 min by high-speed trains from Brussels, 1h from Paris and 1h30 from London). Lille is one of France's top student cities and the university of Lille 1 is a leading center for magnetic resonance. Our research group is internationally known for solid-state methodology and the development of novel glasses with unique properties. We have an expertise in high-field solid-state NMR spectroscopy and pioneered high-field DNP-NMR of hybrid and inorganic materials. Lille NMR facility includes 800 and 900 MHz NMR spectrometers equipped with MAS probes for small-diameter rotors. Our team has also recently patented innovative materials: self-healing glasses and glass-ceramics. These advanced materials have been tested as high temperature joints for SOFC.

The person: We seek application from national and international students who have graduated in physics or chemistry, preferably with a background in material sciences or NMR spectroscopy. The successful applicant will be given the opportunity to work in an exciting environment with national and international collaborations.