

## 第7回機能物質化学講演会のお知らせ

日時：2012年5月17日（木）午後4時～午後5時30分

場所：J棟505室

概要：仏リール第1大学のHervé Vezin博士（CNRS 研究員）が来日するにあたり、本学相模原キャンパスで電子スピン共鳴分光（EPR）を応用した物質科学研究についての講演会を開催いたします。

講演題目：EPR at Work. Modern EPR techniques for studying organic systems: from ancient carbonaceous matter to photochromic molecules

講演者：Hervé Vezin

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講演概要：

For over 30 years modern electron paramagnetic resonance (EPR) using pulsed techniques are a major tool to characterize the paramagnetic centers with a metal in model compounds, the active sites of metalloenzymes and the organic radicals generated by autoxidation or photochemically. The information provided by the EPR on the composition, structure or the environment directly related to the paramagnetic center are obtained by analyzing the hyperfine coupling and sometimes by the quadrupole coupling.

Through several examples as analysis of meteoritic amorphous carbon and charge separation in the zeolite induced by ionization of organic molecule I will present the advantage and power of pulsed EPR spectroscopy. The carbonaceous material, whether of terrestrial origin (coal, ancient cherts, etc ...) or extraterrestrial (carbonaceous meteorites) exhibits paramagnetic defects which the electron spins can be detected with high sensitivity by electron paramagnetic resonance (EPR) using a microwave radiation. In particular we have recently shown that the continuous wave EPR can probe very finely meteoritic Insoluble Organic Matter (MOI). Pulsed and imaging EPR techniques allowed to demonstrate an extreme enrichment in deuterium radicals of the MOI of the Orgueil meteorite. The very detailed analysis and nondestructive of this carbon material shows that it is a good marker of memory of the past.

Photoinduced charge separation is an essential step in the photochemistry of polyaromatics. In solution, this critical step is often hampered by a rapid recombination in the time scale of pico and nano seconds. It is known that under certain conditions, the recombination reaction can be slowed down considerably in the pore volume of zeolites and solid micro-and macroporous. However, knowledge of the phenomena is very partial in particular characterization of the electron photoéjecté was virtually unknown. The main innovative aspect of these results reside in the

formation and characterization of spontaneous ionization and sustainable polyaromatic molecules: biphenyl, naphthalene, anthracene adsorption in the pores of zeolite ZSM-5. Yields (~ 100%) and the lifetimes of radical cations and trapped electrons (~ 1 month) allowed characterization of very thin entities cation radicals and the electron-electron-hole pairs resulting from electron transfer with the subsequent network of the zeolite. The continuous and pulsed EPR spectroscopies have provided decisive results regarding the ionization yields and characterization of spin carriers.

Finally I will present some preliminary results on the EPR studies of photochromic HABI molecules.

#### Reference:

Gourier, H. Vezin, L. Binet, S. Derenne, and F. Robert. 2011. Biradical character of D-rich carriers in the insoluble organic matter of carbonaceous chondrites: A relic of the protoplanetary disk chemistry. *Geochimica et Cosmochimica Acta* 75, (1): 326-336.

Gourier, D., F. Robert, O. Delpoux, L. Binet, H. Vezin, A. Moissette, and S. Derenne. 2008. Extreme deuterium enrichment of organic radicals in the Orgueil meteorite: Revisiting the interstellar interpretation? *Geochimica et Cosmochimica Acta* 72, (7): 1914-1923.

Hureau, Matthieu, Alain Moissette, Hervé Vezin, Claude Bremard, and Maylis Orio. 2012. "Influence of Confinement Effect on Electron Transfers Induced by t-Stilbene Sorption in Medium Pore Acidic Zeolites." *The Journal of Physical Chemistry C* 116 (2), 1812-1825.

Moissette, A., R. F. Lobo, H. Vezin, K. A. Al-Majnouni, and C. Bremard. 2010. Long lived charge separated states induced by trans-stilbene incorporation in the pores of Bronsted acidic HZSM-5 zeolites: Effect of gallium on the spontaneous ionization process. *Journal of Physical Chemistry C* 114, (22): 10280-10290