53rd ENC

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Turcu; Eric Walter; Karl Mueller; *Pacific Northwest National Laboratory, Richland, WA*

The Environmental Molecular Sciences Laboratory (EMSL) is a Department of Energy national scientific user facility, located at Pacific Northwest National Laboratory. The EMSL user facility houses magnetic resonance systems for applications such as 1) ultra high-field NMR for solid-state experiments at 900, 850, 800, and 750 MHz; 2) pulsed EPR spectrometers including a high-power, high-field (95 GHz) system; 3) an ultra high-field radiological wide bore NMR with capabilities for imaging, solution, and solid-state NMR including multi-receiver spectroscopy; and 4) a 500 MHz micro-imaging spectrometer for in-vivo magnetic resonance imaging, localized NMR spectroscopy, and NMR diffusion studies. Capabilities and expertise that contribute to a problem-solving research environment in areas including materials development, catalysis, geosciences, structural biology and metabolomics will be highlighted.

Poster 115

Resource for NMR Molecular Imaging of Proteins

Christopher V. Grant; Chin H. Wu; Stanley J. Opella; *University of California San Diego, La Jolla, CA*

The developments of methods and instrumentation, and their application to membrane bound proteins will be presented. The Resource is dedicated to solid-state NMR spectroscopy for the study of protein structure and function. Recent solid-state NMR methods, applications and developments will be summarized, including solid-state NMR probes optimized for magic angle spinning and static oriented methods. The Resource for NMR Molecular Imaging of Proteins is supported by the National Institute of Biomedical Imaging and Bioengineering (P41EB002031).

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Poster 116

Monitoring *in situ* Copper Electrodeposition Reaction Using NMR Unilateral

Luis Fernando Cabeça; Luiza Maria da Silva Nunes; Luiz Alberto Colnago; *EMBRAPA Instrumentation, São Carlos, Brazil*

We are showing by the first time the coupling of electrochemistry and NMR Unilateral (UNMR) spectrometer (constructed in a classical "U-shaped" geometry). The measurements provide better conditions because the electrochemical reaction takes place outside of the radio frequency (RF) coil probe. The work evaluated the potential of combination between UNMR and electrochemical to monitor in situ cooper electrodeposition. The Cu^{+2} concentrations during the reaction were calculated using CPMG decay (every ten minutes during 3 hours). As expected the Cu^{+2} concentration decrease rapidly with the electrodeposition until approximately 130 min, and then remained constant. After 3 hours reaction, 57.5% of ions in solutions were deposited on the work electrode. These results bring good prospects for monitoring electrochemical reactions in situ.

Poster 117

100x Enhancement of Hyperpolarized Xenon-129 Dissolved-phase Signal During Functional MR Studies of Fatty Tissues

Rosa Tamara Branca[1,2]; Arjun Khanna[2]; Matthew Freeman[3]; [1]*Department of Physics and Astronomy, University of, Chapel Hill, NC;* [2]*Chemistry Department, Duke University, Durham, NC;* [3]*Department of Medical Physics, Duke University, Durham, NC*

Due to its high solubility in blood and tissue and its high sensitivity to the local environment, HP 129-Xe has long been considered a unique probe for imaging living tissues. Unfortunately, imaging results have been disappointing mainly because of the low concentration of xenon that dissolves in tissue. Here we report the first HP 129-Xe functional MR studies of fatty tissues, specifically Brown Adipose Tissue (BAT). Our studies show that HP-129Xe is highly sensitive to BAT activity during which more than a 100x enhancement of the HP 129-Xe dissolved-phase signal can been observed.

Poster 118

A Dynamical Theory of Spin Relaxation

Timothy R. Field; Alex D. Bain; *McMaster University, Hamilton, Canada*

The dynamics of a spin system is usually calculated using the density matrix. However, the usual formulation in terms of the density matrix predicts that the signal will decay to zero, and does not address the issue of individual spin dynamics. Using stochastic calculus we develop a dynamical theory of spin relaxation whose origins lie in the component spin fluctuations. This entails consideration of random pure states for individual protons, and how these pure states are correctly combined when the density matrix is formulated. Both the lattice and the spins are treated quantum mechanically. Such treatment incorporates both the processes of spin-spin and (finite temperature) spin-lattice relaxation. Our results reveal the intimate connections between spin noise and conventional spin relaxation.

Poster 119

Below Cut-off Traveling Wave NMR at 16.4T: Interference of Propagating Modes in a High Dielectric-filled Waveguide

Alexey Tonyushkin[1]; Gregor Adriany[2]; Dinesh Deelchand[2]; Michael Garwood[2]; Andrew Kiruluta[1]; [1]*MGH, Harvard Medical School, Boston, MA;* [2]*University of Minnesota Medical School, Minneapolis, MN*

At ultra-high field strength, the propagation wave vector of the excitation field can no longer be ignored as the wavelength becomes comparable to the imaging volume, particularly if the medium dielectric constant is large. Here, we present our latest developments on a traveling wave waveguide system allowing mode propagation in a 16.4 T horizontal bore NMR imaging system. The waveguide consists of a metal bore of the magnet and an acrylic tube filled with high dielectric material.

The excitation of a waveguide is achieved through a transmit-receive loop coil probe placed at one or both ends of the guide. We describe propagating mode phenomena that were observed in the dielectric and discuss the implications for ultra-high field NMR.

Poster 120

Time Domain NMR Spectroelectrochemistry: Monitoring *in situ* Copper Electrodeposition Reaction