

NMR School Abstracts

The 12th Conference on Magnetic Resonance in Porous Media

9 – 13 February 2014 • Wellington, New Zealand

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NMR-1

COMPACT NMR: HARDWARE, METHODS AND APPLICATIONS

Bernhard Blümich, ITMC-RWTH Aachen University, Germany

Compact NMR machines are small and often portable or even mobile. Depending on their use for materials testing, soft matter studies, and chemical analysis, dedicated devices are employed for relaxometry, imaging, and spectroscopy. While stray-field measurements and imaging are nondestructive and can be conducted on intact objects, spectroscopy is usually applied to samples drawn from larger batches. The different types of NMR sensors are discussed along with representative pulse sequences and applications to liquids and soft matter, polymers, biological tissue, porous materials, and objects of cultural heritage.

NMR-2

NMR DIFFUSION MEASUREMENTS IN POROUS MEDIA: AN INTRODUCTION

Bill Price, University of Western Sydney, Australia.

This session will cover the basics of NMR diffusion measurements. Specifically it will give an introduction to translational diffusion, how it is measured in NMR using pulsed magnetic field gradients and how information on porous media can be extracted from the resulting data.

NMR-3

IMAGING, FLOW MRI, COMPRESSED SENSING AND DATA ANALYSIS

Andrew Sederman

MRRC, Department of Chemical Engineering and Biotechnology, University of Cambridge, Cambridge, UK

In this lecture of the NMR school we will introduce how MR can be used as an imaging technique by the application of magnetic field gradients and how this can be utilised by the porous media community. When applying MRI in porous media the variations in the magnetic fields caused by susceptibility variations require particular practical consideration when designing pulse sequences.

MRI is used for imaging a wide variety contrast parameters such as relaxations times and chemical composition but the ability to accurately measure velocities and molecular motion will be discussed here.

The concept of k-space, as introduced by Mansfield, and the Fourier transform still underpin most image reconstruction but other data analysis methods are becoming more common. As we try to achieve higher temporal resolutions and look at low SNR samples there are obvious benefits to maximising the use of the acquired data (or minimising the data points acquired). In this talk we will introduce the ideas behind compressed sensing image reconstruction which is increasingly being used to produce high resolution images from a reduced set of data points.

NMR-4

NMR RESPONSES FROM PORE FLUIDS IN MICRO - AND MESOPOROUS MATERIALS

Frank Stallmach

Leipzig University, Leipzig, Germany

NMR studies with fluid filled porous materials are performed, since the NMR signal is characteristic for macroscopic and microscopic pore structure parameter of the solid porous hosts. Additionally, transport properties of the pore fluid are often the target in NMR studies. Due to the large internal surface area, in micro- and mesoporous materials the influence of the solid matrix on the NMR response of the pore fluid is generally strong leading often to short relaxation times and small diffusivities. The lecture presents experimental set ups for relaxation and diffusion studies under such conditions. E.g., NMR experiments with adsorbed molecules in crystalline microporous materials like zeolites and metal-organic frameworks at variable elevated gas pressures and with ions in aqueous solutions saturating hierarchically structured mesoporous materials will be discussed. Examples using ^1H , ^{13}C , ^7Li and ^{139}Cs NMR diffusometry and relaxometry will be given.