Materials Seminar

Monday, April 24, 2017

3:30 p.m. in Room 1315 Chemistry

"Sensitizing solid-state NMR spectroscopy for the atomic level characterization of surfaces, materials and pharmaceuticals"

The atomic level characterization of complex materials remains an unanswered scientific challenge. Solid-state NMR spectroscopy could be an ideal probe of atomic level structure since it can be applied to both ordered and disordered materials and complex mixtures. Solid-state NMR spectroscopy also offers unparalleled selectivity, for instance, it is possible to selectively characterize surfaces and interfaces, or perform spectral editing on the basis of spin couplings. However, NMR spectroscopy suffers from intrinsically poor sensitivity due to low polarization of the nuclear magnetic spin states. Poor sensitivity limits or prevents the application of NMR spectroscopy, especially in cases where the species of interest are very dilute, the NMR active nuclei under study are unreceptive, or other mechanisms reduce sensitivity. In this talk I will describe how we address these challenges by using the state of the art NMR technologies of fast magic angle spinning (MAS) and dynamic nuclear polarization (DNP) to enhance the sensitivity of solid-state NMR experiments by orders of magnitude. Fast MAS or DNP enhanced solid-state NMR enables the improved atomic level characterization of surfaces, nano-materials and formulated pharmaceuticals. These techniques also provide access to novel structural information by allowing solid-state NMR spectroscopy to access unconventional elements that are traditionally considered challenging or impossible to utilize for NMR.

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