

Faculty day 2018:

High sensitivity NMR Spectroscopy in Inorganic Solids via Endogenous Dynamic Nuclear Polarization

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The sensitivity boost gained by dynamic nuclear polarization (DNP), a process in which the large electron spin polarization is transferred to surrounding nuclei, expands the applicability of solid state NMR spectroscopy to challenging systems ranging from membrane and amyloid proteins in biology to the surfaces of porous catalysts and nanoparticles in materials science. Typically, DNP is performed by adding a solution of nitroxide radicals to the material of interest. While very efficient, the use of organic radicals limits the sensitivity gain to the surface and sub surface layers of the material and is not suitable for reactive samples.

Here we present an alternative approach which exploits endogenous spin polarization, from metal ions within the material. These are used to sensitize the detection of challenging low gamma, low abundance nuclei at the bulk and interface of technologically relevant oxides. This endogenous DNP approach, used for the first time to study inorganic, non-molecular periodic solids opens the way for sensitive structural characterization of functional materials at natural abundance.