Abstract

Antimatter Probe of Nanostructure and Its Evolution in Microporous Coordination Polymers

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Positron Annihilation Lifetime Spectroscopy (PALS) is an inherently nanoscale probe and as such its real potential in materials characterization is only now starting to be recognized as the nanotechnology initiative actually impinges on the one nanometer scale. An example of how characterization techniques need to be improved at this nanometer level will be considered. Microporous coordination polymers (MCP's) are self-assembled nanocrystalline structures with remarkably high porosity and specific surface areas. Hydrogen storage and CO_2 sequestration are two of the most intensely studied applications with record-setting capacities achieved by MCP's. Ultra-high performance sorbent materials and the fundamental understanding of catalysis in them may be the most exciting, untapped, application of both bulk and beam-based PALS. As nanometer-sized, high porosity molecular frameworks they are absolutely ideal for PALS characterization from *inside the network*. Diffraction techniques probe very accurately the order of the lattice—PALS probes network size, interconnectivity (cage aperture), disorder (defects and damage), and network filling (sorption) all *in-situ*; i.e. during the actual processing. Results of an early study performed with our synthetic chemists here at Michigan on MOF-5 will be presented. Just as MCP's are transforming the field of catalysis it is possible that PALS may transform the characterization of these ultra-high surface area MCP's.