Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Nucleation Pathways of CO2 Condensation under Mesoporous Templated Glass BO WANG, MATTHEW S. BYRAN, GARFIELD T. WARREN, PAUL E. SOKOL, Indiana University , INDIANA UNIVERSITY TEAM, NIST COLLABORATION — Carbon capture and storage (CCS) are important elements in reducing greenhouse gas emission and combating global warming. The adsorption behavior of CO2 under mesoporous confinement at room temperature is particularly relevant. , Small Angle Scattering of X-ray (SAXS) and Neutron (SANS) were used to probe the adsorption process of CO2 under such mesoporous confinement MCM-41 and details of nucleation pathways were mapped out by fitting the scattering intensities with adsorption models. From both experiments, the nucleation of CO2 on the inner pore surface of MCM-41 is found to be a two-step process; high density liquid phase CO2 first forms uniform layers following the long range translational symmetry of the porous matrix, above one CO2 filling, determined by the pore size and temperature, capillary condensation initiates. The nucleation sites formed during capillary condensation start to separate the long range symmetry from the one at uniform layers. Finally, SAXS and SANS techniques are compared and they both showed their unique properties of probing the filling-dependent structures of adsorbed CO2 under such mesoporous system.

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Date submitted: 14 Nov 2014 Electronic form version 1.4