288o Evaluation of Surface Area and Porosity Utilizing Physisorption Isotherms: Porous Materials

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Physisorption isotherms provide information related to the surface structure and morphology of nonporous materials – see preceding article. . In addition, the sorption probes into the molecular sized pores in the surface. The Autoshielding Potential (ASP) concept is based on an exponential decrease in Polyani sorption potential with coverage, see preceding paper. The ASP plots (shown) provide considerable information for a series of MCM41 catalyst samples, (S. Z. Qiao, S. K. Bhatia and X. S. Zhao, Micropor. Mesopor. Mater. 65 (2003) 287) without comparison of the amount adsorbed on the sample compared to that adsorbed on a reference sample which ostensibly has the same surface chemistry and morphology reliable reference isotherms. Each isotherm plot is displaced upward by 10 units. The slight curvature at the low pressure below ca 2X10-5 P(0), is probably due to slow equilibration. The MCM-41 samples were synthesized using alkyltrimethylammonium bromide surfactants with successively longer alkyl chain lengths of 10, 12, 14, 16 and 18 carbons.

Each ASP E(0) = 2228→curve has • The same threshold intercept, E(0)/RT = 14.59 cal/mole(N2) • Similar internal sorption monolayer capacity, Initial Slope = 6.120 mmol(N2)/g • Successively increasing internal multilayer capacity, Extended Linear Region • Successively increasing pore size, Increase Step Ordinate • Successively increasing pore capacity, Increased Step Abscissa • Decreasing external surface area. Second 1.593 mmol(N2)/g • Enhanced interparticulate→Slope = 0.530 condensation, Enhanced Slope and Curvature at High Coverage. Fractal Dimension = 1 The ASP technique provides more information than comparative plots without the tedium, questions concerning surface chemistry, and interpolation to the reference tabulated pressures.