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Direct Measurement of the Adsorbed Film Volume for Estimating Heats of Adsorption ANDREW GILLESPIE, ELMAR DOHNKE, TYLER RASH, DAVID STALLA, ERNEST KNIGHT, FLORIAN SEYDEL, MARK SWEANY, PETER PFEIFER, Univ of Missouri - Columbia — Compressed hydrogen and methane require extremely high pressures or low temperatures in order to compete with the energy density of conventional fossil fuels. Adsorbent materials provide a means to increase the energy density of these gasses up to 6 times that of compressed gas at the same temperature and pressure. One major concern in engineering adsorbed gas systems is thermal management during charging and discharging. Adsorption is an exothermic process, releasing heat during charging and absorbing heat during discharging. To estimate the heat of adsorption, it is common to analyze excess adsorption isotherms by converting to absolute adsorption and employ the Clausius Clapeyron relation. However, this method requires an assumed volume of the adsorbed state. It is common for researchers to assume that the adsorbed film occupies the entire pore volume of the adsorbent material. However, the adsorbed film only occupies a fraction of the total pore volume. This yields heats of adsorption that are underestimated by as much as 10kJ/mol at high coverage. In this talk, we present a method to directly measure the adsorbed film volume as a function of temperature and present the resulting heats of adsorption for both methane and hydrogen.

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