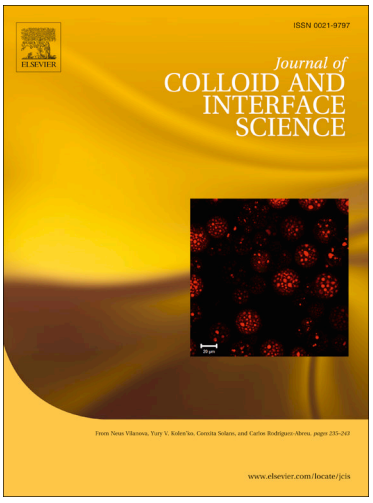

Inferring Pore Connectivity from Sorption Hysteresis in Multiscale Porous Media

Matthew B. Pinson, Tingtao Zhou, Hamlin M. Jennings, Martin Z. Bazant

PII: S0021-9797(18)30859-2
DOI: https://doi.org/10.1016/j.jcis.2018.07.095
Reference: YJCIS 23886

To appear in: *Journal of Colloid and Interface Science*

Received Date: 13 April 2018
Revised Date: 21 July 2018
Accepted Date: 23 July 2018

Please cite this article as: M.B. Pinson, T. Zhou, H.M. Jennings, M.Z. Bazant, Inferring Pore Connectivity from Sorption Hysteresis in Multiscale Porous Media, *Journal of Colloid and Interface Science* (2018), doi: https://doi.org/10.1016/j.jcis.2018.07.095

Inferring Pore Connectivity from Sorption Hysteresis in Multiscale Porous Media

Matthew B. Pinson[a], Tingtao Zhou[a], Hamlin M. Jennings[b,1], Martin Z. Bazant[c]

[a]*Department of Physics, Massachusetts Institute of Technology*
[b]*Department of Civil and Environmental Engineering, Massachusetts Institute of Technology*
[c]*Department of Chemical Engineering and Mathematics, Massachusetts Institute of Technology*

Abstract

Hypothesis
Vapor adsorption experiments are widely used to assess pore size distributions, but the large hysteresis sometimes observed between sorption and desorption isotherms remains difficult to interpret. Such hysteresis is influenced pore network connectivity, which has previously been modeled by percolation on infinite lattices. Our hypothesis is that percolation occurs instead through finite networks of micropores connecting accessible macropores, always exposed to the outside environment.

Theory
We derive a general formula for sorption/desorption isotherms that introduces a simple measure of hierarchical pore connectivity – the fraction of always exposed pores. The model thus accounts for "small world" connections in finite-size percolation, while also incorporating other hysteresis mechanisms, in single-pore filling, liquid insertion into the solid matrix, and cavitation.

Findings
Our formula is able to fit and interpret both primary and scanning sorption/desorption isotherms for a variety of adsorbates (noble gases, water,

[1]Deceased in July 2015. R.I.P.