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Elasticity of argon in nanopores of different sizes

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The elastic properties of porous media are of great relevance in many fields of research. Previous ultrasonic measurements indicate an enhancement of the elastic moduli of adsorbates in nanoconfinement and their dependence on the Laplace pressure [1]. Simulations by Gor et al. have shown that the adsorbate's elasticity is related to the solvation pressure, which also causes the deformation of a porous material during sorption [2]. Thus, for a fully saturated porous material the dependence of the solvation pressure on the pore radius should cause an inverse proportionality between modulus and pore size [2].

Here, we study the effective longitudinal modulus of argon in porous glass samples with different pore sizes and we discuss the effects of nanoconfinement on the adsorbate's elasticity. We have measured the transit times of longitudinal ultrasonic waves propagating through the samples as a function of the relative pressure p/p_0 (with the saturation vapor pressure p_0). From these measurements we determine the effective longitudinal modulus, and we show how changes in the modulus during filling are influenced by the pore size.

Time Block Preference

Time Block B (14:00-17:00 CET)

References

[1] Klaus Schappert and Rolf Pelster, Elasticity and Phase Behavior of Fluids in Nanoporous Media, pp. 259-304 in Soft Matter and Biomaterials on the Nanoscale, vol. 1, Patrick Huber, Ed. (World Scientific, 2020)

[2] Gennady Y. Gor, Christopher D. Dobrzanski and Alina Emelianova, Thermodynamic Fingerprints of Nanoporous Materials on the Fluids Confined in Their Pores, pp. 227-258 in Soft Matter and Biomaterials on the Nanoscale, vol. 1, Patrick Huber, Ed. (World Scientific, 2020)

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Primary authors: Dr SCHAPPERT, Klaus (Universität des Saarlandes); Prof. PELSTER, Rolf (Universität des Saarlandes)

Presenters: Dr SCHAPPERT, Klaus (Universität des Saarlandes); Prof. PELSTER, Rolf (Universität des Saarlandes)

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