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Different measures for the capillarity-driven deformation of a nanoporous metal

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An experimental study were presented that the deformation of nanoporous gold electrodes, wetted by aqueous electrolytes, subject to variation of the capillary forces at the solid surface. The macroscopic dimensional change measured by dilatometry and the lattice parameter change measured by X-ray diffraction differ consistently by the factor of 2. The apparent discrepancy points towards a distinct difference between the action of the surface stress at the solid surface as opposed to the Laplace pressure of the fluid in the pore space. Whereas sorption strain in porous solids is typically discussed in relation to the pressure in the fluid alone, the present observations can only be understood as the consequence of a modified bonding between the (surface-) atoms of the solid. We suggest that the distinction impacts the interpretation of previous findings of sorption strain in porous solids.

Keywords: nanoporous gold, dilatometry, X-ray diffraction, surface stress, Laplace pressure