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Capillary Pressure of a Liquid Between Uniform Spheres Arranged in a Square-packed Layer

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The capillary pressure in the pores defined by equidimensional close-packed spheres is analyzed numerically. In the absence of gravity the menisci shapes are constructed using Surface Evolver code. This permits calculation the free surface mean curvature and hence the capillary pressure. The dependences of capillary pressure on the liquid volume constructed here for a set of contact angles allow one to determine the evolution of basic capillary characteristics under quasi-static infiltration and drainage. The maximum pressure difference between liquid and gas required for a meniscus passing through a pore is calculated and compared with that for hexagonal packing and with an approximate solution given by Mason and Morrow. The lower and upper critical liquid volumes that determine the stability limits for the equilibrium capillary liquid in contact with square packed array of spheres are tabulated for a set of contact angles.

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