Novel phase transitions in chemically heterogeneous slits

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Capillary condensation, i.e. condensation of vapor below the saturation pressure of fluids confined in a capillary slit is a well understood phenomenon which serves as a paradigmatic model for finite-size shifted phase transitions. In this work, we generalize this model to the case, when the slit walls are chemically heterogeneous and are formed of two species of different wettability. Using microscopic density functional theory (DFT), we show that the resulting phase behavior becomes very complex even in the case when the two plates are completely symmetric. Rather than just simple capillary condensation, as in the homogeneous case, the model experiences several phase transitions, such that the full condensation of the fluid inside the slit is preceded by intermediate states characterized by a formation of bridges either *along* or *between* the walls. The stability of these states depending on the geometric parameters of the walls and the distance between the walls is discussed and compared with the analytic prediction based on a mesoscopic analysis.