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Water condensation in proximity of a nanoscale asperity: A density functional description for isotropic fluid PAVEL PARAMONOV, SERGEI LYUKSYUTOV, Departments of Physics, Chemistry and Polymer Engineering, The University of Akron, Akron OH 44325 — A quantitative understanding of water condensation phenomena in proximity of nano- asperities under ambient humidity is important for different applications from scanning probe microscopy to macroscopic adhesion and friction. A non-local density functional formalism is used to describe an equilibrium distribution of the water-like fluid in the asymmetric nanoscale junction. The model system contains spherically curved and planar surfaces presenting an atomic force microscope (AFM) tip dwelling above the surface. The hydrogen bonding dominated in intermolecular attraction of the fluid is modeled as a square well potential with two adjustable energy and length parameters characterizing well's depth and width. The size and shape of the liquid meniscus formed between the surfaces with a given affinity to the fluid are determined for the different values of the ambient humidity. This model can be easily generalized for more complex geometries and effective intermolecular potentials. The results of our study establish a basic framework for the density functional description of the system with orientational anisotropy in the fluid induced by the non-uniform external electric field.

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