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Pseudo-potential Lattice-Boltzmann Method applied to wetting on anisotropic surfaces

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Wetting is frequently used to characterize surfaces via sessile drop experiment. But more than a characterization tool, wetting is studied to develop specific textured patterns in order to functionalise surfaces. For this purpose anisotropic surfaces are widely used to foster a spreading direction of droplets. When surfaces are topographically textured, liquid impregnation is hardly observable during experiments. However, numerical approaches are needed to access more data.

In this work, a lab-built pseudo-potential multi-component Lattice-Boltzmann Method code is applied to wetting. Experimental femtosecond laser grooved surface is discretized to be incorporated into the LBM simulation. The studied surface presents a texturing at the micrometric scale. Then, different materials can be simulated as example PP or PDMS. Indeed, reference contact angle is linked to interaction potentials between each components. It allows to dissociate chemical and topographic properties on wetting.

Many post-processing tools are developed to compute wetting properties over time, which allow static and dynamic analysis of wetting behaviors. The simulations give access to various data as macroscopic contact angle, droplet height, wetting contact area, length or velocity of the triple line. Through simulation results, droplet spreading behavior and wetting regime achieved at equilibrium state are discussed depending on materials.

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