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Dissipative particle dynamics simulation of a liquid meniscus confined between atomic force microscope tip and substrate ZHEN LI, CHUANJIN LAN, YANBAO MA, School of Engineering, University of California, Merced — Liquid meniscus forms between the atomic force microscope (AFM) tip and the substrate under ambient humidity. The liquid meniscus affects the AFM measurements and plays an important role in dip-pen nanolithography. To understand the behaviors of the meniscus, a mesoscopic methodology called dissipative particle dynamics (DPD) is utilized to investigate the liquid meniscus confined between AFM tip and a solid surface. Results show that the structure of the liquid meniscus is highly dependent on the wettability properties of the tip and the substrate as well as the tip-to-surface distance. The area of liquid-solid interface increases as the wetting properties of the tip and substrate change from hydrophilic to hydrophobic, which results in a transition of the meniscus shape from convex to concave. The wetting properties of solid surface affect the process of the liquid meniscus breakup as the tip-to-surface distance increase. This nonlinear process is also affected by the surface tension of the liquid, thermal fluctuation and the speed of tip.

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