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Harnessing Nanoparticles to Control Evaporation at Liquid-Vapor Interfaces XIN YONG, Binghamton University, State University of New York — It is well known that nanoparticles with appropriate size and surface chemistry adsorb to liquid-vapor interfaces and consequently modify the mechanical properties of the interfaces. However, little has been explored about the effect of nanoparticles on the heat transfer occurring at the interfaces. Using many-body dissipative particle dynamics (MDPD), we model an evaporating interface with adsorbed nanoparticles. Homogeneous and amphiphilic Janus nanoparticles, which contain hydrophobic and hydrophobic surface regions, are considered in this study. We measure the variation in the evaporation rates of the interface by gradually increasing particle loading until a hexagonal-close-packed monolayer is achieved. We explore the effect of surface chemistry and surface composition of the particles and demonstrate that evaporation can be readily adjusted by tuning the interaction parameters and amphiphilic ratio. Importantly, we observe that the evaporation suppression by adsorbed nanoparticles occurs only when the ambient vapor pressure is low. This study provides a fundamental understanding of the phase transition in multiphase interfacial systems and opens up new routes to additional control over evaporating interfaces.

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