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Thin Film Evaporation of Receding Meniscus within Micro Pillar Arrays[1] MOHAMED H. ALHOSANI, AMMAR A. ALSHEGHRI, AMAL ALGHAFERI, TIEJUN ZHANG, Masdar Institute of Science and Technology — Evaporation is a key process in power generation, water desalination, and thermal management applications. It has been proved that hydrophilic micro structured surfaces can enhance the convection heat transfer by promoting high-performance thin film evaporation and enlarging the total heat transfer surface area. When depositing a water droplet on hydrophilic structured surfaces, two distinct regions can be observed, a) central region with water level higher than the micro pillar height (droplet region), b) thin film region as a result of liquid meniscus receding among micro structures. In this study, we are able to probe the physics of thin film evaporation of receding liquid meniscus among micro pillar arrays with different pillar heights, spacings and diameters. Heat transfer is systematically studied in the droplet and thin film region for each sample. Also, Young-Laplace equation and kinetic theory of mass transport are used to model the thin film evaporation around micro pillars. With the proposed model, the shape of meniscus around micro pillars and the diameter of droplet/extended thin film region can be predicted and compared with the experimental measurement. The model can also be extended to model thin film evaporation of meniscus within nano structured surfaces.

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