How wettability affects heat transfer

Understanding the mechanisms governing water condensation on surfaces is crucial to a wide range of applications that have a significant societal and environmental impact, such as energy conversion, water harvesting, water desalination, thermal management systems and environmental control.

Likewise, enhancement of heat transfer coefficients for condensation is an active area of research. Conventionally, some of the methods employed to enhance condensation heat transfer coefficients is chemical treatment of the condensation surface, exploiting surface texture to drain the condensate, and adding chemicals to the vapor to affect its interaction with the surface.

The interaction of the condensate with the condensation surface is an important factor that controls the heat transfer process. If the condensed fluid quickly coalesces, it forms a thin film and wets the entire surface, film wise condensation (FWC) is said to have taken place. This is a result of high surface energy of the condensation surface and is observed on surfaces which are hydrophilic. On the other hand, drop wise condensation (DWC) occurs in the form of liquid droplets on surfaces which are not fully wetted by the liquid and is a result of low surface energy of the condensation surface; such surfaces are said to be hydrophobic. DWC is characterized by higher drop contact angles of the droplets when compared to that of FWC.

It is now well recognized that dropwise condensation is more effective than filmwise condensation [1]. But how to improve again the condensation phenomenon ?

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