

Electric Field Enhanced Jumping Droplet Condensation

Technology #16192

Applications

This technology is applicable to droplet condensation heat transfer systems.

Problem Addressed

Heat transfer on condensation surfaces decreases dramatically once a liquid film forms on the condenser, so the heat transfer rate is inherently limited by how quickly the accumulated liquid can leave the surface. Conventional condensation heat exchangers rely on gravity to shed liquid, which limits the overall heat transfer performance. This technology adds another mechanism for droplet removal, allowing the system to support a larger heat transfer rate.

Technology

On super-hydrophobic surfaces, when two or more small droplets coalesce, the reduction in surface energy often causes the resulting drop to spontaneously jump away from the condenser surface. This mechanism can significantly speed up liquid removal from the condenser, enabling faster heat transfer. However, at high condensation rates, the vapor flow towards the condenser can push the jumping droplets back onto the surface, preventing effective liquid removal. This technology uses an electric field to counter the effect of the vapor flow. The droplets gain a net positive electrostatic charge as they jump off the condensing surface. The external electric field is oriented to apply a downward force on the jumping droplet and cancel out the upward force from the vapor flow. This allows the droplets to successfully leave the condenser, maximizing liquid removal and heat transfer.

Advantages

- Increased heat transfer rate in droplet condensers
- Adaptable to a variety of geometries

Categories For This Invention:

Energy

Energy Efficiency

Heat Exchangers

Intellectual Property:

Condensation on surfaces

Issued US Patent

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Publications:

[Electric-Field-Enhanced Condensation on Superhydrophobic Nanostructured Surfaces](#)

ACS Nano

November 21, 2013

[Electric Fields Can Push Droplets from Surfaces](#)

MIT News

December 20, 2013

External Links:

Device Research Laboratory

<http://drl.mit.edu/>

Image Gallery:

