Superwetting Surface for Diminishing Leidenfrost Effect
Technology #14259

Applications

Superwetting surfaces can increase heat transfer and efficiency in two-phase cooling devices (heat exchangers).

Problem Addressed

Heat exchangers use boiling to transfer heat away from a solid. However, boiling is limited by the critical heat flux (CHF), which occurs at the Leidenfrost point, where a vapor is generated between the droplet and solid surface. The vapor causes heat transfer via conduction, which leads to dry-out and slows down heat transfer. A superwetting surface reduces the effects of the Leidenfrost effect by preventing vapor formation and continuously rewetting the surface; therefore, improving overall heat transfer.

Technology

Surface roughness can be used to create a superwetting surface that can fundamentally alter droplet-surface interactions to continuously rewet the surface and prevent vapor film formation. Micro scale square posts are fabricated on silicon wafers with photolithography followed by a reactive ion etch. Silica particles with different diameters, 15-75nm, are spin-coated and sintered on the substrates already having micro scale square posts to create a hierarchical structure. The textured surfaces significantly enhance nucleate boiling and diminish the Leidenfrost limits, which increases heat transfer and reduces dryout.

Advantages

- Increases critical heat flux
- Increases boiling efficiency

Categories For This Invention:

Energy
Heat Exchangers
Materials
Hydrophobic/Hydrophilic

Intellectual Property:

Superwetting surfaces for diminishing leidenfrost effect, methods of making and devices incorporating the same
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Publications:
Increasing Leidenfrost Point Using Micro-nano Hierarchical Surface Structures
Applied Physics Letters
103, 201601 (2013)

External Links:
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http://varanasi.mit.edu

Image Gallery: