Copper Oxide Surfaces for Enhanced Condensation

Technology #15479

Applications

Applications for this technology are found in heat exchangers for power generation and water distillation.

Problem Addressed

A variety of industrial plants depend on water vapor condensing on metal plates. To improve the efficiency of these plants, the key is to increase the condensers' heat-transfer coefficient. On a typical, flat-plate condenser, water vapor condenses to form a liquid film on the surface, drastically reducing the condenser's ability to collect more water until gravity drains the film. This acts as a barrier to heat transfer. The challenge is to remove this thermal barrier by removing the water droplets as quickly as possible.

Technology

This technology related to scalable surfaces with nanoscale features that barely touch the droplets. The nanostructured pattern itself is made of copper oxide and forms on top of the copper tubing. The process produces a surface that resembles a bed of tiny, pointed leaves sticking up from the surface; these nanoscale points minimize contact between the droplets and the surface, making release easier. The nanostructured patterns can be made and applied under room temperature conditions and the growth process naturally stops itself. After the pattern is created, a hydrophobic coating is applied when a vapor solution bonds itself to the patterned surface without significantly altering its shape. As a result of this technique, droplets do not fall from the surface but actually jump away from it, thus increasing the efficiency of the process. The energy released as tiny droplets merge to form larger ones is enough to propel the droplets upward from the surface, meaning the removal of droplets does not solely depend on gravity.

Advantages

- Increased nucleation density
- Smaller structure length scales
- Enhanced condensational heat transfer

Categories For This Invention:

Energy
Energy Efficiency
Heat Exchangers
Power Plants
Water Treatment
Desalination

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Intellectual Property:

Superhydrophobic Nanostructures
US Patent Pending
2013-0244001

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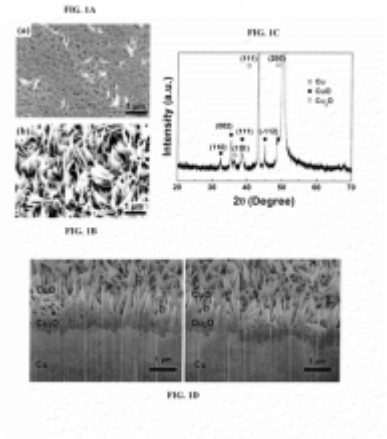
Publications:

Research Update: Jumping Droplets Help Heat Transfer
MIT News
January 4, 2013
Jumping-Droplet-Enhanced Condensation on Scalable Superhydrophobic Nanostructured Surfaces
Nano Letters
January 9, 2013 p. 179

External Links:

Device Research Laboratory
http://drl.mit.edu/

Image Gallery:



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