RJPHY Research Journal of Physics

OPEN ACCESS

News & Comments

Scientists Managed to Boil Water Faster

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AttachedBoiling water or other fluids is an energy-intensive step in many industrial processes, such as most electricity-generating plants, many chemical production plants, and even cooling systems for electronics. Not just for industrial purposes, but water gets boiled a lot, from brewing a cup of tea in the kitchen to power generation. So, improved efficiency of water heating and evaporation systems could significantly reduce their energy consumption. These systems can now be made more efficient using a specially designed surface treatment developed by MIT researchers. Using three different types of surface modification, Youngsup Song has designed a surface treatment that optimizes such an important process. Boiling is described by two main parameters: the heat transfer coefficient (CTC) and the critical heat flux (FCC). A balance between the two is generally sought in the design of these materials so that anything that improves one of these parameters tends to worsen the other.

The Leidenfrost effect occurs when enough bubbles form on the boiling surface, which means that boiling is very efficient; however, if excess bubbles form, they can coalesce and form a layer of vapor that prevents heat transfer from the hot surface to the water; this causes the water drops to dance on the surface.

The team was finally able to significantly improve both properties of the material at the same time by adding different textures to the surface.

They added a series of microscale tubes in an array of 10-micrometer-wide tubes, spaced about 2 millimeters apart, which controlled bubble formation by keeping them pinned to the cavities, thus preventing vapor film. it simultaneously reduces the concentration of bubbles on the surface, reducing boiling efficiency which was tackled by introducing an even smaller-scale treatment as the second modification. They added bumps and ridges just nanometers in size within the surface of the hollow tubes. Which increased the available surface area and promoted evaporation rates. A series of pillars were arranged on the surface of the material to house the microscale cavities. By adding more surface area, these pillars speed up the drawing-off process. Together, these factors result in a significant improvement in boiling efficiency. These modifications are believed to work for different kinds of liquids thus improving their application.

KEYWORDS

Mechanical Engineering, MIT, Nanotechnology, Popular, Leidenfrost effect, boiling water, boiling surface, boiling, water heating, evaporation, water, energy efficiency, microstructure, physics, latest