# Radiative cooler that cools down even under sunlight

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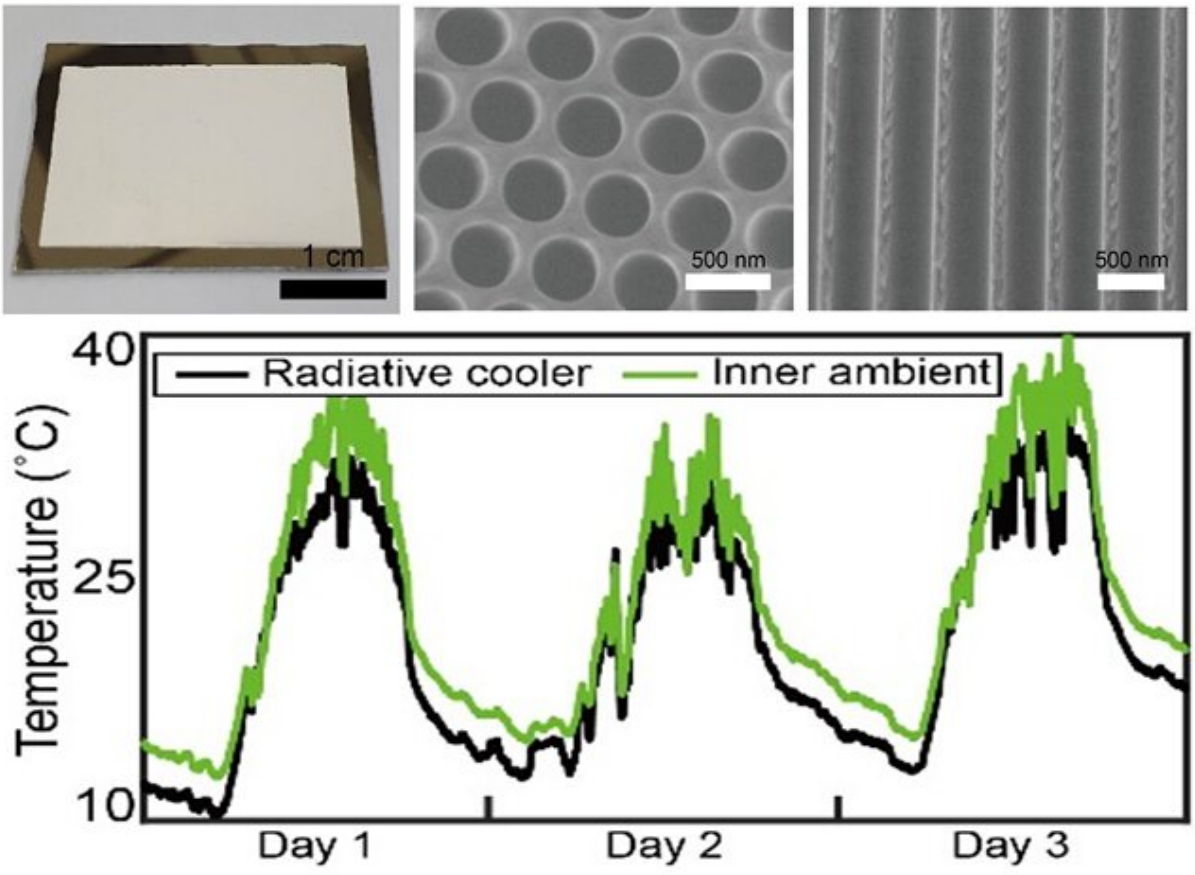


Above: Photograph of fabricated radiative cooler (left). Images of the cooler captured from top (right) and cross-section (right) using the scanning electron microscope (SEM).
Below: Graph of temperature measured over three days. Radiative cooler (black line) is observed to have lower temperature than its ambient temperature (green line).

Credit: Pohang University of Science & Technology (POSTECH)

Now that autumn is upon us, there is a large temperature gap between day and night. This is due to the temperature inversion caused by radiative cooling on the Earth's surface. Heat from the sun during the day causes its temperature to rise and when the sun sets during the night, its temperature cools down. Recently, a joint research team from POSTECH and Korea University has demonstrated a daytime radiative cooling effect which exhibits lower temperatures than its surroundings even during the day.

Professor Junsuk Rho and Ph.D. candidate Dasol Lee of departments of mechanical engineering and chemical engineering and Professor Jin Kon Kim and Ph.D. candidate Myeongcheol Go in the Department of Chemical Engineering at POSTECH have conducted a joint study with Professor Heon Lee of Materials Science Engineering at Korea University to successfully realized an energy-free radiative cooling technology using silica-coated porous anodic aluminum oxide. The study was published in the latest online edition of *Nano Energy*.

With growing interest in energy consumption, such as environmental pollution and limitations in using fossil fuels, attempts to lower the temperature without consuming energy continue. Radiative cooling is an example of structures installed on windows or walls to reduce the building temperature by reflecting sunlight or by absorbing and radiating far-infrared light. Radiative cooling is a technology that allows objects to receive less energy from the sun and lower temperatures by emitting radiative heat.

Unlike conventional cooling systems, radiative cooling is difficult to apply to large areas, although it has the advantage of significantly reducing energy consumption like electricity. Research to overcome this issue is being actively carried out around the world but it is still challenging to commercialize the technology.

To this, the joint research team found a very simple solution. Just by coating the porous anodic aluminum with a thin film of silica, it has been confirmed that there is a cooling effect that exhibits a lower temperature than the surroundings even under direct sunlight.

Experiments have confirmed that an optimized structure can have a reflectivity of 86% in the solar spectral region and a high emissivity of 96% in the atmospheric window (8-13 μm). In addition, the radiative cooling material—produced in centimeters—showed a cooling efficiency of up to 6.1°C during the day when the sunlight was strong.

"This newly developed radiative cooling material can be easily produced," explained POSTECH Professor Junsuk Rho. He added optimistically, "It will help solve environmental problems if applied to heating and cooling systems since it can be readily applied to large areas."

**More information:** Dasol Lee et al, Sub-ambient daytime radiative cooling by silica-coated porous anodic aluminum oxide, *Nano Energy* (2020). DOI: 10.1016/j.nanoen.2020.105426

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