

RESEARCHERS CREATE ULTRA-WHITE PAINT THAT CAN COOL YOUR HOME

Relevant for: Science & Technology | Topic: Science and Technology- developments and their applications and effects in everyday life

Xiulin Ruan, a Purdue University professor of mechanical engineering, holds up his lab's sample of the whitest paint on record. Credit: Purdue University/Jared Pike

Researchers from Purdue University in the U.S. have developed an 'ultra-white' paint, which when painted onto buildings, can reflect the sunlight falling on them and lower the temperature indoors by 4.5 degrees Celsius than the surroundings. They say this can alleviate global warming on two counts; by reducing carbon emissions from air conditioners, and driving the sun's incoming heat away to outer space – a principle called radiative cooling.

The able to achieve this by adding Barium sulfate(BaSO_4) to acrylic paint, imparting a reflectance of 98.1%. This marked an improvement over the team's earlier work last year that made use of Calcium carbonate(CaCO_3) as a filler material to produce a paint that boasted 95.5% reflectance. To lend context, heat-reflective commercial white paints in the market possess reflectance ranging from 80 - 91%. But they are unable to maintain a temperature consistently lower than the surroundings throughout the day.

Speaking to *The Hindu* over email, Xiulin Ruan, who headed the team, says "Our previous CaCO_3 paint could consistently cool 1.7 degrees Celsius below the ambient temperature. The new BaSO_4 paint can cool 4.5 degrees Celsius below the ambient surroundings." The findings were published recently in the journal [ACS Applied Materials & Interfaces](#).

In BaSO_4 , they found a compound with low heat absorption and high sky emissivity. The compound, characterised by a high electron band-gap, requires greater energy for an electron to jump from the valence band to the conduction band and start conducting heat. This ensures there is minimal absorption of the heat falling on the surface.

"The previous paint absorbs 4.5% sunlight while the new paint only absorbs 1.9%, representing a 58% reduction of heat gain from the sun. For a one-story house with a 100m² roof area, this represents an increase of 2.6 kW cooling power for the new paint," Dr. Ruan says.

By adopting a relatively high volume concentration of 60%, and employing particles of varying sizes rather than a uniform one, the BaSO_4 -acrylic paint is able to reflect sunlight at a wavelength suitable enough to pass through the atmosphere during the day and take it to deep space — a principle called sky emissivity. The paint functioning in this manner can offer an average cooling power of 117 W/m².

"We did some simple analysis...and found out that you could save up to 70% air conditioning cost in the summer," Dr. Ruan says.

But there are apprehensions that the gains made this way could be offset by heating requirements during winter. When asked about this, Dr. Ruan says: "Right now, this paint will be most suitable for hot climates where air conditioning in the summer is the primary need rather than heating in the winter. On certain days, you might not need to turn on the air conditioner while on other very hot days, you need to turn on air conditioner, but the paint can help offset some cooling demand. "

“However, it is possible to develop dynamic coatings to switch properties between summer and winter hence used for all climates, but it will take some time,” he adds.

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