

Researchers say cool white paint could combat urban heat

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By **Jim Morrison**

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A quest going back decades to find the ultimate cool white has led to the creation of a paint that researchers say reflects up to 98.1 percent of sunlight and sends infrared heat away from a surface, making it cooler than the surrounding air.

Covering buildings with the new paint, which is headed to the commercial market in the next two years, could reduce the need for air conditioning, decrease the use of fossil fuels and help combat the problem of urban heat islands, an increasing health concern as temperatures rise, according to researchers at Purdue University.

“If you look at the energy [savings] and cooling power this paint can provide, it’s really exciting,” said [Xiulin Ruan](#), a Purdue mechanical engineering professor whose team published its results in the journal ACS Applied Materials & Interfaces.

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Painting buildings white to reflect sunlight and make them cooler is common in Greece and other countries. Cities like New York and Chicago have programs to paint roofs white to combat urban heat. White paint now on the market reflects 80 to 90 percent of sunlight, but it gets warmer, not cooler, by absorbing ultraviolet light.

The breakthrough Ruan and his team say they have made is creating a paint that both reflects and cools.

They began by looking at 100 different materials before narrowing them to 10 and then eventually over six years down to one — barium sulfate, which is used to make photo paper and cosmetics.

They found that a high concentration of barium sulfate particles in different sizes created the best reflective results. Instead of using one size of the particle, they used a variety, changing the results for the better. Outdoors, the paint made surfaces 19 degrees Fahrenheit cooler than the air at night, according to their tests. Even during the midday heat, it was effective, reducing surface temperatures to eight degrees below the air temperature. That would make it not only the whitest paint, but also the coolest.

“What our paint does is not only remove heat, it also sends it off to deep space, helping reduce the heat island effect,” Ruan said.

As the world warms, urban heat islands have become deadly. According to the Environmental Protection Agency, daytime temperatures are up to seven degrees higher in urban areas and nighttime temperatures up to five degrees higher than in outlying areas. In some neighborhoods, especially poor, minority areas, where tree cover tends to be sparser, the difference can be as much as 20 degrees during the day. In some cities, climate models indicate that the number of high-heat days could double by 2040.

Globally, heat is the No. 1 weather-related cause of death, claiming more lost each year than floods, tornadoes or hurricanes. It is a crafty killer, taking lives not only through heat stroke, but also by exacerbating existing conditions such as heart and lung disease, kidney problems, diabetes and asthma. Decreasing building temperatures not only during the day, but especially at night, giving people a chance to cool off and hydrate, means they're less likely to suffer heat-related health problems.

Other researchers, though, have been cautious about the paint's promise. Ronnen Levinson, the leader of the Heat Island Group at Lawrence Berkeley National Laboratory, said the ultrabright paint is a small improvement on what is already commercially available. He is a co-author of a 2019 study that found that in warm cities, from Miami to Albuquerque, sunlight-reflecting walls were as useful as cool roofs and could result in annual energy cost savings of up to 11 percent for retail stores and up to 8.3 percent for single-family homes.

"Cooling benefits are usually evaluated after a reflective material has been outside for a few years," he said. "I don't really know how the ultrabright white will perform then. But from its initial properties, when it's clean, it's about a 10 percent performance boost over today's bright-white roof coatings."

Levinson said the reflection of ultraviolet light, a key property of the paint, has a downside. Sending it back into the sky stimulates the creation of smog through an interaction with nitrogen oxides and volatile organic compounds. Whether the positive effects of reducing temperature would outweigh the negative effects of increasing smog is a question to be answered, he added.

But the researchers say they envision a potentially bigger role for the paint — cooling the Earth. If less than 1 percent of the planet's surface were covered in the brightest white paint, temperatures worldwide would drop about 1 degree Celsius, Ruan said. "If that's the last solution we want to try," he said.
