VIDEO ARTICLE

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Designing Porous Polymers for Daytime Radiative Cooling

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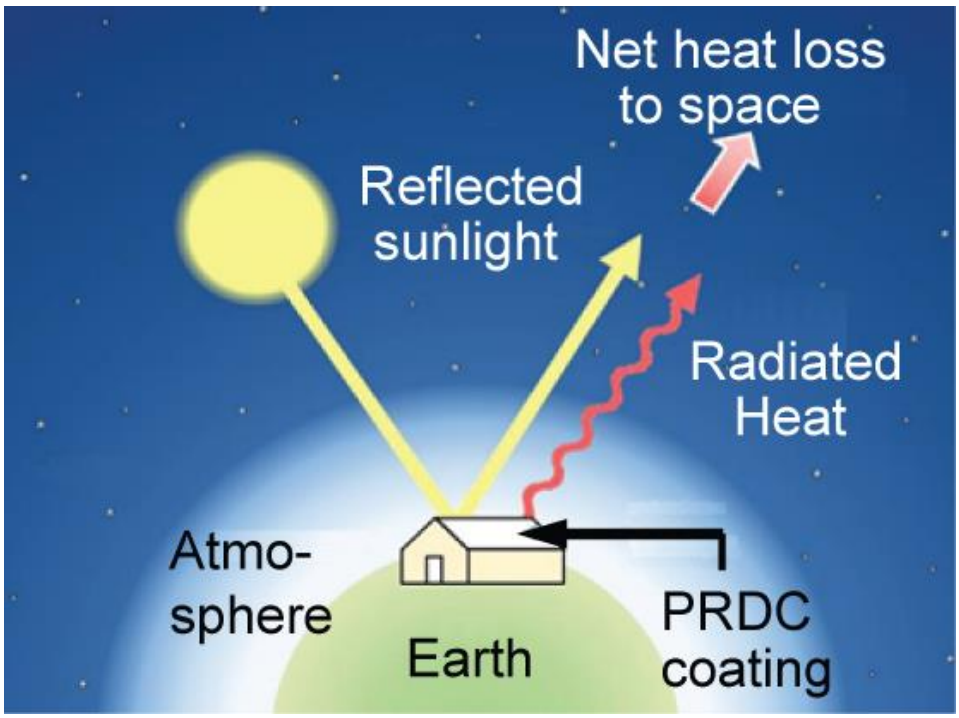
Graphical Abstract



Abstract

Passive Daytime Radiative Cooling (PDRC) is an electricity-free method for cooling terrestrial entities. In PDRC, a surface has a solar reflectance of nearly 1 to avoid solar heating, and high emittance close to 1 in the long wavelength infrared (LWIR) transparent window of the atmosphere (wavelength λ = 8- 13 μm) for radiating heat to the cold sky. This allows the surface to passively achieve sub-ambient cooling. PDRC requires careful tuning of optical reflectance in wide optical spectrum. Various designs have been demonstrated for PDRC in the last decades, including emissive dielectric on a reflective metal substrate, and highly reflective paints. In the talk I will present our recent studies on developing porous polymers with excellent PDRC performance. The high density of nano/micropores in polymer leads to efficient light scattering at the interface between the polymer and air, which effectively enhance solar reflectance and thermal emittance. High solar reflectance above 0.96 and high thermal emittance of 0.97 are achieved simultaneously. A temperature 6^{o}C cooler than the environment is observed at noon in Phoenix. Moreover, the process is solution-based and highly scalable.

Keywords: Radiative cooling, fluoropolymer, solar reflectance, thermal energy.

References

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Biography of Presenting Author

Yuan Yang is currently an associate professor of materials science in the department of applied physics and applied mathematics at Columbia University. He received his B.S. in physics at Peking University in 2007, followed by the completion of his Ph.D. in materials science and engineering at Stanford University in 2012. After graduation, he spent three years in the department of mechanical engineering at MIT, until 2015. He has published more than 70 journal papers with citation >20,000 times, including *Science*, *Joule*, *Nature Communications*, *Science Advances* as the corresponding author. Dr. Yang's research interests include advanced energy storage and thermal energy management. He won Young Innovator Award by *Nano Research* in 2019. He is a Scialog fellow on Advanced Energy Storage and won RISE award at Columbia University in 2017.

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