

Transparent Radiative Cooling for Enclosed Spaces by Flexible Self-Cleaning Janus Emitter

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Passive daytime radiative cooling is a sustainable method for reducing temperature by reflecting solar radiation and releasing heat into outer space.¹ However, its application in enclosed environments remains challenging due to the accumulation of heat caused by the greenhouse effect, especially in transparent systems.² To address this issue, we developed the Janus Transparent Radiative Cooler (JTRC), a flexible and transparent device with dual-sided functionality. One side serves as a selective infrared emitter, while the other functions as a broadband emitter. This design allows the device to efficiently release internal heat while preventing external heat from entering. When used as an energy-saving window, the cooler not only achieves effective temperature reduction but also suppresses heat buildup in enclosed spaces, performing comparably to conventional transparent radiative coolers. With its flexibility, transparency, and strong thermal performance, the device shows great potential for practical applications in vehicles, buildings, and electronic devices that require efficient thermal management.³

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