Novel Passive Radiative Cooler Which Combined Magnesium Oxide and Aluminum Foil

Endo, Ami (School: Shizuoka Kita High School)
Yagi, Yuki (School: Shizuoka Kita High School)
Umehara, Meika (School: Shizuoka Kita High School)

In recent years, the demand for cooling has surged, prompting growing interest in passive radiative cooling (PRC) technology has attracted considerable attention because it does not require energy or the use of refrigerants. However, high cost, inadequate weather resistance, and ineffective solar reflection limit the use of PRC materials. This study revealed that novel PRC effects can be achieved by dispersing magnesium oxide (MgO) on aluminum (Al) foils by using silicon dioxide (SiO2). After MgO transformed external heat into infrared rays of wavelengths of 8–13 μm (atmospheric window) at a high ratio, these infrared rays then passed through SiO2, penetrated the atmosphere, and were emitted into space. A simple dehydration condensation reaction was conducted by adding ethanol to a mixture of MgO powder and sodium silicate. Because of the minimal use of organic matter, ultraviolet rays did not considerably degrade the PRC material, Thus, the PRC material exhibited excellent weather resistance, durability, refractoriness, and high flexibility because of its pliancy. On application to the external surface of a building, the developed PRC material reflected 70–80% of the sun's infrared rays by the Al foil. The heat that was not reflected was radiated by the PRC of MgO to achieve a cooling efficiency of 235 W/m2 during daytime. Eventually, indoor air conditioning power usage decreased by 36%. This indicated a reduction in urban heat island effects through decreased reliance on air conditioning systems, lowering the wastage of electric power and discharge of greenhouse gases.

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