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Passive radiative cooling systems using coatings

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At present, the focus should be on the use of renewable energy. Radiation cooling is one of the passive methods used to reduce energy consumption and protect the environment. Passive cooling includes technologies and design features designed to cool buildings with minimal energy consumption, allows to use simple and inexpensive equipment to ensure comfort in regions with hot climates and can be used to store food, liquids and other materials at a temperature below the ambient temperature.

Radiative cooling is a very well-known cooling technique as it was used during the ancient time to produce ice and cool spaces. It is based on the potential of the terrestrial structures to dissipate heat From its outer surface to a lower temperature.. The ability to modify the radiative properties of an object is of great interest and important in various areas of engineering and applied physics. The thermal emission/absorption spectra of a body can be changed by altering the geometry of the structure and the material used.

Past research on radiative cooling was aiming at identifying natural or creating composite materials insures specific properties, where ideal materials for radiative cooling should present: (a) The maximum possible reflectivity in the short-wave range (0.25–2.8 μm, with the majority of the solar power available between 0.3 and 2.2 μm); and (b) emissivity in the atmospheric window band close to unity (8–13 μm) and zero in the rest of the thermal wavelength range (4–80 μm).at least as close as possible. Research was oriented towards the use of commercially available polymers, metals, gases, or simply synthesized composite materials to form a radiative cooler. The dependency on inherent properties of natural or composite materials or, in other words, the incapability to precisely control their optical spectrum significantly limits the cooling performance. In facts, very few structures achieved Low temperature of outer surface than ambient temperature in daytime conditions, but most of the proposed structures demonstrate the desired results clearly during the night period.

Newly proposed passive systems of radiative cooling like advanced paints, offer a high potential for radiative cooling at considerably low prices, passive radiative cooling systems using paints do not making use of expensive materials like silver while are available in a simple and easy to use a paint format, and it’s a solution process the coating can be very easily applied to many different substrates such as concrete, metal, plastic and wood.

The goal of the research evaluates the thermal and optical performance of the coating used for passive radiation cooling , determine the best materials used in the composition of the coating , determine the proportion of each of these materials within it, and then determine the optimum thickness of the coating.

Previous studies have suggested low refractive index microspheres of SiO_2 is found to present an absorptivity in the shortwave range of less than 0.03, while its emissivity in the atmospheric window spectrum was higher than 0.95. The absorptivity of the radiator in the solar spectrum was 0.02, day time surface temperature depression below ambient temperature12 ℃ . Other studies have found that a material for passive daytime radiative cooling vinylidene fluoride-cohexafluoropropene (P(VdF-HFP)HP), it causes reflectance in the solar spectrum is close to 0.96 while its emissivity in the atmospheric window is 0.97, and shown a daytime temperature

depression up to 6 ℃ below the ambient temperature. Further research will be conducted with these coatings.

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