A New Approach for Optimizing a Light Scattering Coating Formulated With Different Sized $BaSO_4$ Particles for Energy Conservation Applications

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Passive daytime radiative cooling (PDRC) guarantees reducing the cost of space cooling in a variety of applications. However, commercialization issues still exist for the production of PDRC materials with low costs and high solar band reflectivity. The aim of this research project is to optimize a cost-effective and efficient radiative-cooling paint formalization to achieve maximum light scattering by utilizing an optimized combination of different sizes of $BaSO_4$ particles. $BaSO_4$ was introduced in various particle sizes using the ball-milling method for 0, 2, 4, 6, 8, 10, 24, 48 hours at 400 RPM. DLS, XRD, and FESEM analyses were used to characterize and determine the particle sizes of ground materials. DLS showed that particle size decreased (1.82 uM–50 nm) as ball-milling time was increased (0–48 hours). The broadness of the peaks in the XRD data increased, indicating a decrease in particle size. $BaSO_4$ and a polymeric binder were combined in a 3:1:2 ratio, producing a homogeneously ultra-white coating. In the NIR region, the spectrophotometer showed promising results, with the third sample having 99% solar reflectance. Along with an 8-degree drop in the temperature of the formulated coating compared to the commercial paint sample under a solar simulator. The transmission percentages reported by the Turbiscan graph, which ranged (25%-5%), supported this: S3 > S4 > S5 > S2 > S6. It is cost-effective since 1kg of $BaSO_4$ costs 0.4$, which is half the price of TiO_2 used in commercial paint. By applying the formulated paint to building surfaces by spraying or coating, it has the potential to alleviate the urban-island-effect, thus decreasing the CO_2 footprint from the energy consumed for cooling applications.

Awards Won:

China Association for Science and Technology (CAST): Award of $1,200

Second Award of $2,000