Development of Nanoparticle Coatings for Self-Cleaning Applications: Case Studies on Solar Cell Panels, Mirrors, and Concrete Surfaces of Places of Worship

Self-cleaning coatings are very significant for specific technical applications. These coatings can be categorized into two primary types: superhydrophobic and superhydrophilic coatings. Nanoparticle coatings have the potential to prevent dust formation in solar energy systems, which increases the amount of light that is transmitted and improves the efficiency with which energy is converted. The coatings offer anti-fogging and stain-resistant features for architectural mirrors, which ensures that the mirrors will remain clear for an extended period of time and require less care. Coatings on concrete surfaces, especially those of religious or cultural importance, protect them from weathering, biological development, and pollution-induced discoloration. Furthermore, the coatings maintain the material's structural and aesthetic qualities.

Using solar cell panels, mirrors, and the concrete surfaces of places of worship as examples, this keynote presentation describes the development, and characterization of nanoparticle coatings for self-cleaning applications. This study investigated the development of superhydrophilic self-cleaning coatings for solar panels using colloidal silica nanoparticles. The coating thickness was evaluated with a nano search microscope, and the surface microstructure was examined using scanning electron microscopy. The water contact angle (WCA) was evaluated utilizing a contact angle meter. The average film thickness is 2.0 μm, and the contact angle is 13.0º. The results demonstrate that colloidal silica nanoparticle coatings significantly improve surface properties, providing advantageous self-cleaning functions suitable for solar panel use.

In this keynote, I will also introduce KMUTNB Rayong Campus and provide some basic information regarding the preparation of JCREN2026.

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