Utilization of Rosoideae rosa Nanostructures for Optimization of Solar Cell Light Management

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The project incorporates common rose (Rosoideae rosa) nanostructures, especially their anti-reflective and light management properties, in a photoresist film to increase photovoltaic cell efficiency. The nanostructure coating was expected to reliably improve the efficiency of the solar panel as it was also expected that PDMS would near-perfectly transfer the nanostructures. Rosoideae Rosa petal samples were collected and replicated in photoresist via PDMS molds. They were applied to photodetectors and tested against an unmodified photoresist coating as a control under the conditions of no light, low light (0.05 μW/cm2), and ordinary light conditions (2.24 μW/cm2). Efficiency was compared with responsivity, which measures the ability for the photodetector to generate current given the power of the light striking it. To obtain reliable results, multiple iterations (32) were made to perfect a PDMS mixture that could transfer the rose nanostructures without defect. The nanostructure coating did improve photovoltaic cell responsivity under low and ordinary light. Specifically, under normal light conditions, the nanostructures increased the responsivity from 0.670 amps/watt for the control to 0.904 amps/watt, a 34.9% increase. A t-test revealed a t-value of 17.3 and a negligible p-value, indicating statistical significance. Under low light, the improvement was 36.5%, from 0.577 to 0.787. The t-value was calculated to be 4.80 for a p-value of 0.003. These results thus confirm the efficacy of Rosoideaea rosa nanostructures as solar panel coatings and raise possibilities for other applications in nanoscale optical coatings.

Awards Won:

Third Award of $1,000