UltraSolar: Increasing Photovoltaic Efficiency via a Novel Low-Cost Add-on of Fluorescent and Phosphorescent Solutions

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This research aims to design a cost-effective add-on to solar cells that allows for the capture of solar ultraviolet light. While scientists have created expensive multijunction panels that capture UV, these panels only increase output by 1.5% and don't improve upon existing photovoltaic cells. Since certain translucent chemicals glow under UV light, these fluorescent chemicals (at various concentrations) were placed on solar cells to convert UV to visible light. From last year's research, antifreeze was the most effective solution at a 2.2M concentration. Building off past results, the ideal depth of liquid was calculated. Additionally, since antifreeze is toxic, its fluorescent component (propylene glycol, which is environmentally-safe) was isolated and tested. The two chemicals were not significantly different, both generating ~45.1% more output than conventional solar cells. To make this technology mass-producible, a custom polycarbonate box was 3D-printed and milled to enclose the solution. Both the polycarbonate and the previously-used polypropylene container resulted in similar outputs (41.7% increased output from standard panels). When placed on a rooftop, a similar increase in output occurred. In order to reflect wasted fluorescence back to the solar panel, a one-way narrow-band reflective filter was used. Despite its material cost, it increased efficiency and may be used in applications where the expense is unimportant. This innovation improves the reliability of solar energy because it increases generation during daylight hours, cloud cover, and nighttime, all for $0.81/cell. This low-cost solution can revolutionize rooftop panels, solar farms, satellites, and solar panels in developing nations for energy independence.