Semi-transparent PV coatings for greenhouse application

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This project develops coating materials and techniques to enable fabrication of semi-transparent photovoltaics (PV) that are specifically suited for greenhouse agriculture, with the goal of realizing Net Zero Energy (NZE) Greenhouses with economically viable agricultural functions. Greenhouse-agriculture-specific requirements on PV-i.e. desirable transparency at different parts/wave-length ranges of the solar spectrum—are determined via biological/physiological studies by our IEB team, where the growth characteristics of various commodity plants under various PV-simulating shading conditions are quantified. Using the biological/physiological data as guidance, our NTU team develops a facile area-selective coating technique to fabricate PV's meeting the transparency requirements. Moreover, our Gdańsk Tech team joins force with the NTU team to carry out a comprehensive approach to enhance the efficiency and stability of the PV's, encompassing additive engineering, interface passivation, device physics modeling, device stability characterization, developing high-performance encapsulants, developing wavelength-selective reflectors, and developing transparent electrodes with high conductivity and stability. Working concurrently, our IPV team leverages its commercial capabilities to turn the lab-scale results into large-area, high-throughput, and manufacturing-worthy processes, culminating into the production of a prototype greenhouse that can be used for field study and demonstration. The project is on pace to accomplish its stated objective at the end of the project period, with all partners onboard in planning continued collaboration to see the project results through full fruition, making real contributions to addressing the global issues of climate change and sustainability.