Engineering Hybrid System to Generate Renewable Energy From Solar and Raindrop Energy Using Newly Designed Compatible Piezoelectric Devices

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By 2030, the world must ensure access to affordable, reliable, sustainable energy. However, the power generated from two potential renewable energy resources -solar cells and raindrop piezoelectric devices- is limited. Solar cells depend entirely on sunlight, and their efficiency drops when subjected to excessive heat. Raindrop piezoelectric devices have slow responses to vibrations because of the large-scale design, and the device bending mechanism exposes them to breakage. Therefore, this project aims to fabricate compatible microstructural piezoelectric devices using LiNbO3 as a piezoelectric material that detects raindrop vibrations more efficiently and can respond to sunlight and heat; then integrate those devices on the solar cell to create a hybrid system that eliminates heat efficiency drops and generate energy from sunlight and raindrops. The hybrid system integrates fabricated piezoelectric device wafers over solar cell silicon wafers using different methods, such as wafers or adhesive bonding. Several peak-to-peak voltages (VPP) and power tests have been done using an oscilloscope and multimeter. The fabricated piezoelectric devices achieved a VPP of 0.35V and a power of 235mW from one raindrop. Also, the piezoelectric devices demonstrate a significant response to high temperatures with a VPP of 7.54V at 70°C and a power of 0.3W at 77°C. After assembling the hybrid system, the added VPP values reached 22.6% (from sunlight) and 8.3% (from raindrops). This hybrid system can be installed in any solar-energy farms or solar-cell cars to maximize the energy production of both existing devices, allowing energy production during most weather conditions.

Awards Won:
Third Award of $1,000