Principles of Electrowetting on Liquid Prism Beam-Steering Module

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Solar energy has become more practical recently and is one of the fastest growing industries around the world due to the influx in demand for renewable energy. Mechanical trackers have been used to steer solar radiation onto concentrated photovoltaic cells; however, the efficiency of these mechanical trackers has greatly hindered the widespread use of this method. I am introducing an electrowetting-driven solar tracking system that overcomes the use of these mechanical trackers. The electrowetting-driven solar tracker consists of electrowetting assisted liquid prisms that are filled with two immiscible fluids that have a large difference in refractive indices. The modules, which would hold the liquid prisms, were constructed out of indium tin oxide coated class and were coated with fluoropolymer PFC1610V and paralyene C in order to get the conductive and hydrophobic properties required for the modules. The modules were then filled with two immiscible fluids to create the interface that was manipulated. The two fluids were a solution of water containing potassium chloride and sodium dodecyl sulfate and the other silicon oil. Copper wires were attached to each of the walls in order to be able to charge each of the four walls of the modules independently. Through experimentation, I have derived a graph that can accurately compare the applied voltage to the contact angle of the interface. With this information, I can apply it to a larger array of modules that can be used to collectively steer solar radiation onto a concentrated photovoltaic cell.

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