Researchers Have Created a Flexible Solar Cell That Can Be Submerged in Water

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Courtesy of SynEvol

An organic photovoltaic film that is flexible and waterproof has been developed by researchers at the RIKEN Center for Emergent Matter Science and their collaborators. With the help of this cutting-edge film, solar cells may now be included into clothing, keeping their usefulness even after washings and exposure to the rain.

Creating wearable electronics—devices that may be affixed to garments and monitor medical devices, for example, without requiring battery changes—is one of the possible applications for organic photovoltaics. Researchers have discovered that it is difficult to accomplish waterproofing without adding more layers, which ultimately reduce the film's flexibility.

Now, some scientists have managed to achieve just that, as reported in a publication that was published in Nature Communications. They took on the task of conquering a significant drawback of earlier models, namely the difficulty of making them waterproof without sacrificing their flexibility. Usually, photovoltaic films consist of many layers. An active later is used to extract specific wavelengths of energy from sunlight and split electrons and "electron holes" between an anode and a cathode. Electricity can then be produced by the electrons and holes reuniting via a circuit. In earlier devices, stacking was typically used to produce the layer that transported the electron holes consecutively.

In the present study, however, improved adhesion between the layers was achieved by the researchers depositing the anode layer—a silver electrode, in this case—directly onto the active layers. The film was subjected to air at 85 degrees Celsius for a full day as part of a thermal annealing procedure. The original author of the work, Sixing Xiong, stated that "we were happy to have accomplished it and were able to create a film that was just 3 micrometers thick, and we looked forward to seeing the results of tests." However, forming the layer proved difficult.

The results of the tests were highly encouraging to the group. After submerging the film entirely in water for four hours, they discovered that 89% of its original performance remained. After that, they stretched a film by thirty percent 300 times underwater, and discovered that the film still maintained ninety-six percent of its original performance. They put it through a washing machine cycle as a last test, and it made it through the ordeal—something that had never been done before.

One of the paper's accompanying authors, Kenjiro Fukuda, claims, "What we have created is a method that can be used more generally." Looking ahead, we intend to continue developing our ultrathin organic solar cells in order to make them suitable for use in extremely useful wearable devices by enhancing the stability of devices in additional contexts, such as exposure to air, intense light, and mechanical stress.”