ORGANIC PHOTOVOLTAICS

Washable solar cells

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Encapsulated organic photovoltaic cells are promising candidates for wearable power sources owing to their high power conversion efficiency, mechanical robustness and stability against some environmental factors. Conventional encapsulation barriers have indeed proven to be effective against air and moisture ingression while retaining good mechanical flexibility. However, washability, another crucial aspect to textile integration, has been poorly addressed despite some promising initial results. Now, Seok Ho Cho, Kyung Cheol Choi and colleagues at the Korea Advanced Institute of Science and Technology and Chonnam National University have used an oxide capping layer on top of an aluminium oxide/zinc oxide encapsulation barrier to provide a textile-based optoelectronic module with improved water impermeability.

The researchers suggest that the cause of degradation in the barrier layers is a phase transition occurring in the aluminium oxide when immersed in water. They demonstrate that this can be prevented with a capping layer of a silicon oxide-based polymer that stabilizes the aluminium oxide. To test the encapsulation water resistance, they constructed organic solar cells on a polyethylene naphthalate fabric and conducted washing tests in detergent-containing water. Only 2% of the device power conversion efficiency was lost after 20 washing cycles of 10 minutes each. This result motivated the researchers to test the encapsulation barrier also on a textile-based module composed of organic solar cells and light-emitting diodes, a prototype of self-powered smart clothing. Encouragingly, after 30 days of washing and bending tests, more than 92% of the module performances were retained.

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