Several organizations have demonstrated self-assembling electronic devices, using the fact that oil and water based liquids do not mix. These effects exploit the effect of gravity, such that when the fluid lands on the substrate it moves slightly to settle into defined mesas, enabling high resolution device features. However, despite the demonstrators to date this process has not been scaled or conveniently used to manufacture electronics because resin has been able to demonstrate this working with high yield.

Recently the proceedings of the National Academy of Sciences documented a new self assembly technique developed at the University of Minnesota that was designed to enable high volume, high yield wafer scale manufacturing. The process involves making the electronic device at the interface between oil and water. Their demonstration product is a solar cell, where they have built a wafer-like “grid” that absorbs the light for individual solar elements. The grid is coated with a hydrophobic material (that attracts water).

The materials used in the test were silicon cubes with side lengths of about 20-60 µm, with a gold contact on one side. The gold contacts were coated with a hydrophobic material and the silicon sides was coated by a hydrophobic molecule.

When added to an oil-water mixture, the researchers found that the cubes assembled nearly along the liquid interface, using this process the researchers were able to create a sheet of the elements that float between the oil/water boundary. The device grid is then passed through the oil/water boundary slowly, and element lines into place mostly on the grid substrate as the silicon attracts its gold contact.

Using this process at 95 degrees Celsius, the research team made a working solar cell comprising of 64,400 elements in just three minutes. The team is now researching how small they can make individual elements and how large finished devices can be.

Top image source: BBC

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