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A Conversation with Henry Snaith

Mark Peplow

The Oxford physicist is racing to bring perovskite solar cells to market.

Henry Snaith, professor of physics at the University of Oxford, is at the forefront of developing photovoltaic devices made from a class of materials known as perovskites. Compounds such as methylammonium lead iodide demonstrate remarkable abilities to convert light into electricity, and could offer a much cheaper alternative to conventional silicon solar cells. Mark Peplow caught up with Snaith, recently elected as a fellow of the Royal Society, to discuss perovskite solar cells' commercial prospects.

Why are perovskites causing such a stir in photovoltaics research?

The first reports of perovskite solar cells came from Japan in 2009, and since then we've pushed them up toward 20% power conversion efficiency. So they went from nowhere to being competitive with the best crystalline photovoltaic materials in just a few years. They're also very easy to produce—you start from inexpensive salts and just mix them together.

Perovskites look like they should reach even higher efficiencies, up toward 30%. So they could be not just the lowest cost technology, but also the highest efficiency technology.

How are you trying to commercialize perovskite cells?

I spun out a company called Oxford Photovoltaics in 2010. A commercial product will have to last for 25 years or more, so a lot of the commercial effort goes into ensuring that all the layers of the solar cell are stable, and will withstand extremes of temperature, light, and humidity. Then we're moving on to scaling up the area of the cells.

Our first target is to put these perovskite cells directly on top of crystalline silicon solar cells in a tandem configuration, which could increase the 20% efficiency of a commercial silicon cell up to 25% or more. That way we get a direct entry into utility-scale silicon photovoltaics, which is the biggest photovoltaic market. Our aim is to get the first pilot line producing cells in 2017. Ultimately, it may be that we have an all-perovskite tandem cell that beats a perovskite–silicon cell.

What are you doing to improve the perovskites' performance?

A number of things affect the performance of the cells. We're doing a lot of work on the crystallinity of the material, how big the grains are, what the nature of the grain boundaries are, and whether there are defects that reduce the performance.

We're losing a lot of voltage at the interface between the perovskite and the electronic contacts that sandwich it. So we're trying different contact materials, including titanium dioxide, C_{60}, and semiconducting polymers.

We also want to be able to process all the layers below 150 °C, so that we can put a perovskite cell on top of high-efficiency silicon cells without having to heat it up and recrystallize it.

Is the lead content of perovskites a problem?

The cells are going to be very well encapsulated, so the risk of leakage is minimal. But we will have to recycle modules, just as First Solar [based in Tempe, Ariz.] does for their cadmium telluride solar cells. It wouldn't just go to landfill. We are also looking at lead-free alternatives as a backstop.

Perovskites are also moisture sensitive—how are you testing their ability to survive outside the laboratory?

The silicon photovoltaic industry typically exposes its devices to 85% relative humidity at 85 °C for 3,000 hours, and with

Published: July 10, 2015

DOI: 10.1021/acscentsci.5b00220
ACS Cent. Sci. 2015, 1, 159–160

that they're happy the stuff will last for 25 years. At the moment we're doing well on the 1,000 hour tests, and now we're getting ready for 2,000 hour tests.

Do you ever worry that perovskites won't live up to their promise?

It doesn't worry me, because I think something very useful will come out of it. We have the possibility to create a technology that could transform the power industry. If we didn't even try, *that* would be a failure. And if it doesn't work, it would be the basic physics or material properties that have failed. We will try our hardest to make it a success.

Mark Peplow is a freelance contributor to Chemical & Engineering News, the weekly newsmagazine of the American Chemical Society, Center Stage interviews are edited for length and clarity.

DOI: 10.1021/acscentsci.5b00220
ACS Cent. Sci. 2015, 1, 159−160