Scientists detect residue that has hindered efficiency of promising type of solar cell

May 6 2013, by Jared Sagoff

Because of their potential to reduce costs for both fabrication and materials, organic photovoltaics could be much cheaper to manufacture than conventional solar cells and have a smaller environmental impact as well.

(Phys.org) —Drivers who have ever noticed a residue on their windshields after going through a car wash will sympathize with nanoscientist Seth Darling's pain.

Darling and his colleagues at the U.S. Department of Energy's Argonne National Laboratory have worked for years to develop a new type of solar cell known as organic photovoltaics (OPVs). Because of their potential to reduce costs for both fabrication and materials, OPVs could be much cheaper to manufacture than conventional solar cells and have a smaller environmental impact as well.

The major drawback of OPVs, however, is they aren't as efficient as conventional solar cells. In a new study, Darling and his colleagues at Argonne's Center for Nanoscale Materials and Advanced Photon Source (APS) were able to detect for the first time a major contributing factor to this limitation: trace residues of catalyst material left over from the development process prevent the OPVs from converting the maximum amount of sunlight to electricity.

"Scientists have recently become aware that impurities can cause problems in these nanostructured materials, but until now, we didn't have a way of actually being able to see that the impurities were even there," Darling said.

Although many previously used techniques lacked the ability to identify the presence of a remaining catalyst, Argonne physicists Barry Lai and Jörg Maser were able to get a clear picture of the impurities by using a technique called X-ray fluorescence, which involves high-intensity X-rays from the APS.

The residual impurities impede the performance of the solar cell because they tend to "trap" the electrical charges that the solar cell generates after it is hit by a photon. The metal atoms involved in the development process – specifically palladium – cause the trapping effect.

The next step for the research involves looking at ways to remedy or prevent the trapping, but in the meantime, chemists and manufacturers

of organic solar cell materials have already begun to take note and pay attention to the quantity of residual catalyst left behind in their products.

According to Darling, researchers had been aware for some time of an analogous problem in organic light-emitting devices, which work on the reverse principle of solar cells – rather than converting light to electricity, they convert electricity to light. "It's actually a bit surprising that scientists didn't recognize that this problem could also occur in solar cells until relatively recently," Darling said.

The results of the research are published in an article titled "Detection and role of trace impurities in high-performance organic solar cells" in the May 2013 issue of *Energy and Environmental Science*.

Provided by Argonne National Laboratory