

New green materials could power smart devices using ambient light

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We are increasingly using more smart devices like smartphones, smart speakers, and wearable health and wellness sensors in our homes, offices, and public buildings. However, the batteries they use can deplete quickly and contain toxic and rare environmentally damaging chemicals, so researchers are looking for better ways to power the devices.

One way to power them is by converting indoor [light](#) from ordinary bulbs into energy, in a similar way to how solar panels harvest energy from sunlight, known as solar photovoltaics. However, due to the different properties of the light sources, the [materials](#) used for solar panels are not suitable for harvesting indoor light.

Now, researchers from Imperial College London, Soochow University in China, and the University of Cambridge have discovered that new green materials currently being developed for next-generation solar panels could be useful for indoor light harvesting. They report their findings today in *Advanced Energy Materials*.

Co-author Dr. Robert Hoyer, from the Department of Materials at Imperial, said: "By efficiently absorbing the light coming from lamps commonly found in homes and buildings, the materials we investigated can turn light into electricity with an efficiency already in the range of commercial technologies. We have also already identified several possible improvements, which would allow these materials to surpass the performance of current indoor photovoltaic technologies in the near future."

The team investigated 'perovskite-inspired materials', which were created to circumvent problems with materials called perovskites, which were developed for next-generation solar cells. Although perovskites are cheaper to make than traditional silicon-based [solar panels](#) and deliver similar efficiency, perovskites contain toxic lead substances. This drove the development of perovskite-inspired materials, which are instead based on safer elements like bismuth and antimony.

Despite being more environmentally friendly, these perovskite-inspired materials are not as efficient at absorbing sunlight. However, the team found that the materials are much more effective at absorbing indoor light, with efficiencies that are promising for commercial applications.

Crucially, the researchers demonstrated that the power provided by these materials under indoor illumination is already sufficient to operate electronic circuits.

Co-author Professor Vincenzo Pecunia, from Soochow University, said: "Our discovery opens up a whole new direction in the search for green, easy-to-make materials to sustainably power our smart devices.

"In addition to their eco-friendly nature, these materials could potentially be processed onto unconventional substrates such as plastics and fabric, which are incompatible with conventional technologies. Therefore, lead-free perovskite-inspired materials could soon enable battery-free devices for wearables, healthcare monitoring, smart homes, and smart cities."

More information: Yueheng Peng et al. Lead-Free Perovskite-Inspired Absorbers for Indoor Photovoltaics, *Advanced Energy Materials* (2020). [DOI: 10.1002/aenm.202002761](https://doi.org/10.1002/aenm.202002761)

Provided by Imperial College London

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