PUBLISHED: 8 AUGUST 2017 | VOLUME: 2 | ARTICLE NUMBER: 17137

research highlights

THERMOELECTRICS

Invisible harvest

Nat. Commun. **8,** 16076 (2017)

Energy harvesting focuses on the recovery of energy from ubiquitous sources such as small temperature differences (tens of degrees or less) around room temperature. Thermoelectric devices convert spatial temperature differences into electric power and vice versa. Therefore, transparent thermoelectrics could be used to harvest ambient energy or to cool optoelectronic devices. To do so, matching n-type and p-type thermoelectric elements are required. However, only n-type transparent thermoelectric materials have been developed so far. Now, Chang Yang and colleagues from Germany, China and the UK report transparent and flexible p-type thermoelectric thin films based on copper iodide thin films.

The researchers build on recent reports of the high electronic p-type conductivity of a transparent crystalline phase of copper iodide. The researchers deposit copper iodide film by sputtering on glass or plastic substrates. On glass, the thermoelectric figure of merit, ZT, reaches about 0.21 at 300 K, comparable to that of p-type PbTe, a common bulk thermoelectric material, and about a thousand times higher than previous p-type transparent thermolectrics. The thermoelectric properties of the p-type film on a plastic substrate are tested under compressive and tensile stresses, and are used to estimate the power output of a full transparent and flexible module and its expected conversion efficiency. For a temperature difference of 50 K, the expected conversion efficiency is about 0.8%, which is close to the measured performance of bulk PbTe-based modules. Copper iodide is non-toxic and Earth-abundant and the researchers propose to use extrinsic doping and nanostructuring to further enhance transparent thermoelectric performances.

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