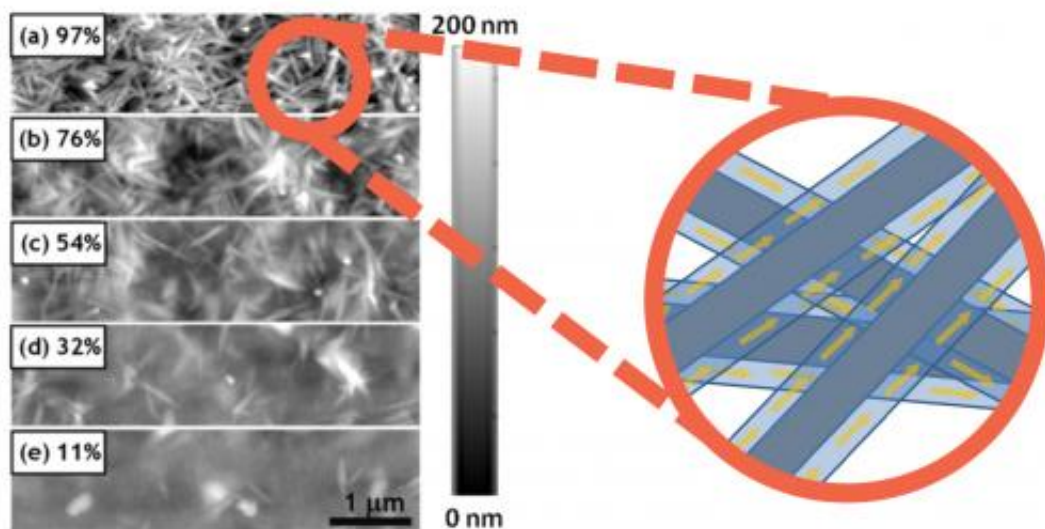


Composite organic/inorganic thermoelectric is more than sum of its parts

May 7 2013, by Alison Hatt

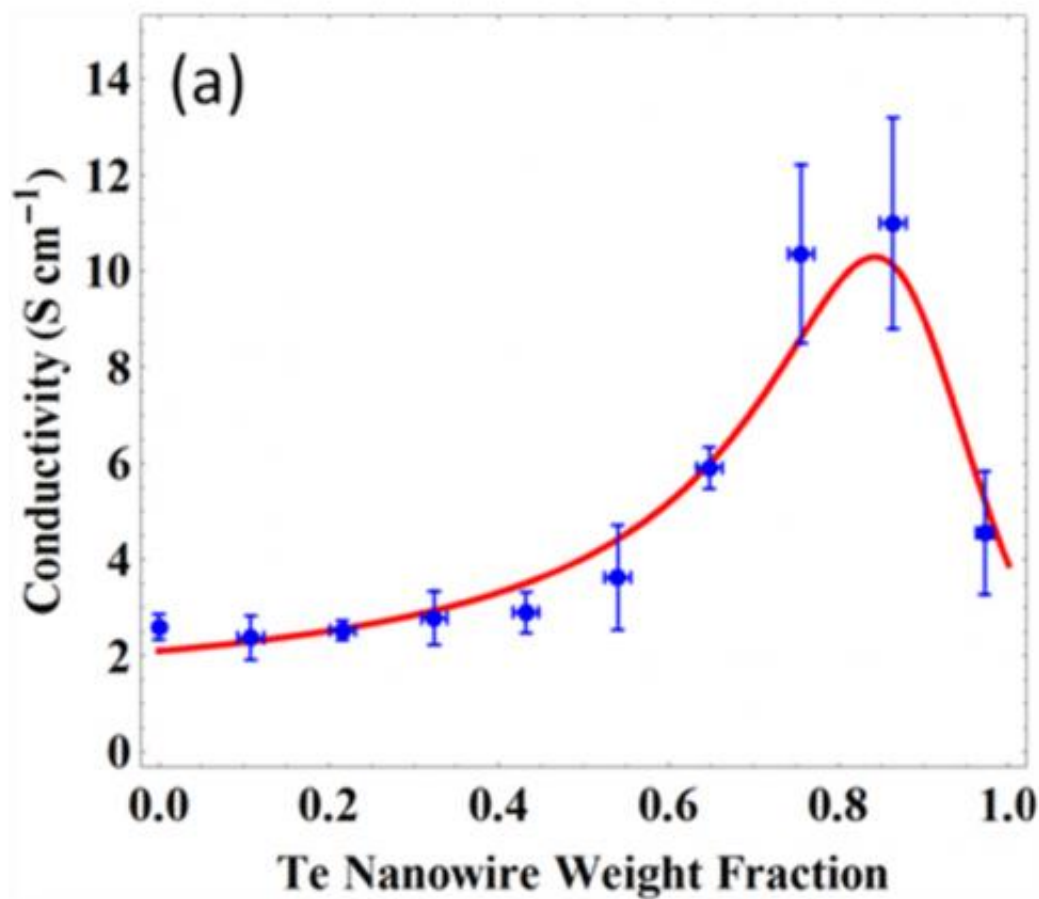


Atomic force micrograph of nanowire-polymer composite films of varying composition, and schematic of highly conductive interfacial phase.

(Phys.org) —A team led by Berkeley Lab Materials Sciences Division's Jeffrey Urban and Rachel Segalman have discovered highly conductive polymer behavior occurring at a polymer/nanocrystal interface. The composite organic/inorganic material is a thermoelectric – a material capable of converting heat into electricity – and has a higher performance than either of its constituent materials. The results may impact not only thermoelectrics research, but also polymer/nanocrystal composites being investigated for photovoltaics, batteries, and hydrogen

storage.

An efficient thermoelectric material made from polymers and nanocrystals is an attractive prospect as it would be significantly cheaper to fabricate than traditional thermoelectrics. Here the researchers synthesized tellurium nanowires with PEDOT:PSS, a common [conducting polymer](#), and cast thin films of the resulting solution. Intriguingly, the team found that the composite films had higher thermoelectric performance than either the polymer or nanowires alone.



High electrical conductivity is seen in composite polymer/nanowire films corresponding to an intermediate weight fraction of tellurium nanowires.

The researchers rationalized their unusual results by modeling the films as a composite of three distinct materials: nanowires, bulk polymer, and a new interfacial polymer phase with increased [electrical conductivity](#). The highly conductive interfacial polymer phase suggests new routes to enhancing electronic and thermal properties in hybrid materials and devices, for thermoelectric energy conversion and other energy applications.

More information: Coates, N. et al. Effect of Interfacial Properties on Polymer–Nanocrystal Thermoelectric Transport, *Advanced Materials* 25, 1629-1633 (2012). [DOI: 10.1002/adma.201203915](https://doi.org/10.1002/adma.201203915)

Provided by Lawrence Berkeley National Laboratory

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