

# Breakthrough in converting heat waste to electricity

January 18 2011, By Erin White

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(PhysOrg.com) -- Researchers at Northwestern University have placed nanocrystals of rock salt into lead telluride, creating a material that can harness electricity from heat-generating items such as vehicle exhaust systems, industrial processes and equipment and sun light more efficiently than scientists have seen in the past.

The material exhibits a high thermoelectric figure of merit that is expected to enable 14 percent of heat waste to [electricity](#), a scientific first. Chemists, physicists and material scientists at Northwestern collaborated to develop the material. The results of the study are published by the journal *Nature Chemistry*.

"It has been known for 100 years that semiconductors have this property that can harness electricity," said Mercuri Kanatzidis, the Charles E. and Emma H. Morrison Professor of Chemistry in The Weinberg College of Arts and Sciences. "To make this an efficient process, all you need is the right material, and we have found a recipe or system to make this material."

Kanatzidis, co-author of the study, and his team dispersed nanocrystals of rock salt (SrTe) into the material lead telluride (PbTe). Past attempts at this kind of nanoscale inclusion in bulk material have improved the energy conversion efficiency of lead telluride, but the nano inclusions also increased the scattering of electrons, which reduced overall conductivity. In this study, the Northwestern team offers the first example of using [nanostructures](#) in lead telluride to reduce electron

scattering and increase the [energy conversion efficiency](#) of the material.

"We can put this material inside of an inexpensive device with a few electrical wires and attach it to something like a light bulb," said Vinayak Dravid, professor of [materials](#) science and engineering at Northwestern's McCormick School of Engineering and Applied Science and co-author of the paper. "The device can make the light bulb more efficient by taking the heat it generates and converting part of the heat, 10 to 15 percent, into a more useful energy like electricity."

The automotive, chemical, brick, glass and any industry that uses heat to make products could make their system more efficient with the use of this scientific breakthrough, said Kanatzidis, who also has a joint appointment at the Argonne National Laboratory.

"The energy crisis and the environment are two major reasons to be excited about this discovery, but this could just be the beginning," Dravid said. "These types of structures may have other implications in the scientific community that we haven't thought of yet, in areas such as mechanical behavior and improving strength or toughness. Hopefully others will pick up this system and use it."

**More information:** The title of the paper is "Strained endotaxial nanostructures with high thermoelectric figure of merit." Paper online: [www.nature.com/nchem/journal/v ... /full/nchem.955.html](http://www.nature.com/nchem/journal/v.../full/nchem.955.html)

Provided by Northwestern University

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