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## Thermoelectric (TE) Device made using PbTe Nanocrystal Coated Glass Fibers

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### ABSTRACT

Around 60 % of the energy produced in the U.S. in 2013 was wasted and most of this was dissipated in the form of heat. Thermoelectric materials could potentially harvest part of the energy being wasted by converting heat energy into electrical energy. Lead telluride nanocrystals are an interesting thermoelectric material particularly for solution-based coating of flexible substrates. The purpose of this project is to develop a working thermoelectric device using p-n pairs of PbTe nanocrystal coated glass fibers. In this project, p- and n- type PbTe nanocrystals are synthesized in solution. Bare glass fibers are sequentially dipped in solutions of PbTe nanocrystals to form a layer of PbTe, diluted aqueous hydrazine to remove organic ligands, and acetonitrile to wash away the hydrazine. The procedure is repeated to achieve a sufficiently thick nanocrystal coating on the glass fibers. The coated glass fibers are then used to make a prototype thermoelectric device with alternating p-type and n-type segments placed electrically in series and thermally in parallel. The device is placed in a temperature gradient and the resistance, current, voltage, and power output are measured. We found that the device has a resistance of approximately 33 M $\Omega$  and generates a power output of 5.3 pW in a temperature gradient of 20 Kelvin.

### KEYWORDS

PbTe nanocrystals, thermoelectric device, glass fibers, coating, nanotechnology