Researchers at the University of South Florida have developed bulk nanocomposites for enhancing the performance of thermoelectric devices.

Direct conversion of heat to electricity through thermoelectric power generation holds great promise for lightening the burdens of our ever-increasing energy needs. Thermoelectrics (TE) have advantages in many respects, including simplicity, safety and reliability. However, current materials utilized by this technology have been the limiting factor in achieving higher thermoelectric efficiencies. In addition, energy conversion applications also require materials in large quantities. Therefore, there is a need for new materials and synthesis methods to further the development of clean and efficient large scale energy conversion systems for applications in Automotive Waste Heat recovery, Onboard Power Generation for space probes and refrigeration.

To address this need, our inventors have developed bulk nanocomposites via nano-scale fabrication. Dense lead telluride (PbTe) nanocomposites are synthesized from PbTe nanocrystals by employing a low-temperature solution-phase reaction. We have optimized this technique to produce large quantities of nanocrystals. Then, Spark Plasma Sintering is employed for densification, which integrates nanoscale grains within a bulk matrix. This dimensional integration of bulk materials with nanoscale enhancement offer superior thermoelectric properties.

**ADVANTAGES:**

- Process optimization achieves high yield
- Uses a cost effective and stable material
- Enhances thermoelectric efficiency by increasing Seebeck co-efficient S
- Nanocomposite synthesis eliminates conglomeration of the nanograins

**Bulk Nanocomposites Provide Greater Thermoelectric Efficiency**

**SEM micrograph of PbTe1 fracture surface indicating 100 nm to over 1 μm grains distributed within a bulk material**

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