High-Performance, Low-Cost Thermoelectric Cooling Materials

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Objective

Develop high-performance low-cost thermoelectric materials based on ultra-small Bi_2Te_3 nanocrystals.

Approach

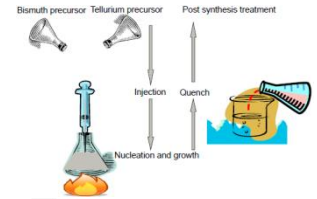
Bottom-up

Wet-chemistry synthesis using the pyrolysis of organometallic compound

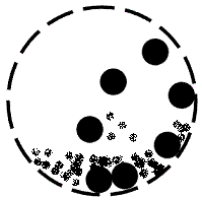
Top-down

Ball milling of bulk materials

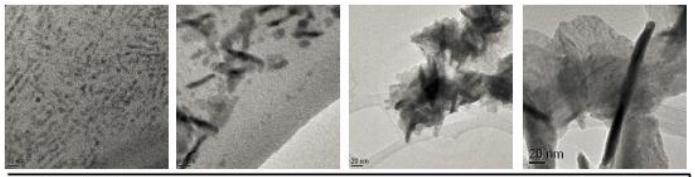
Wet-Chemistry Synthesis



Ball Milling

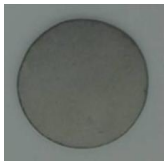


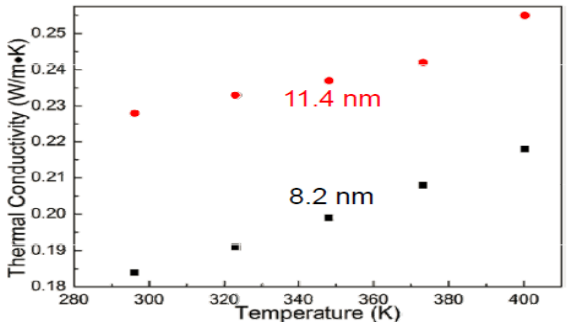
source: Wikipedia

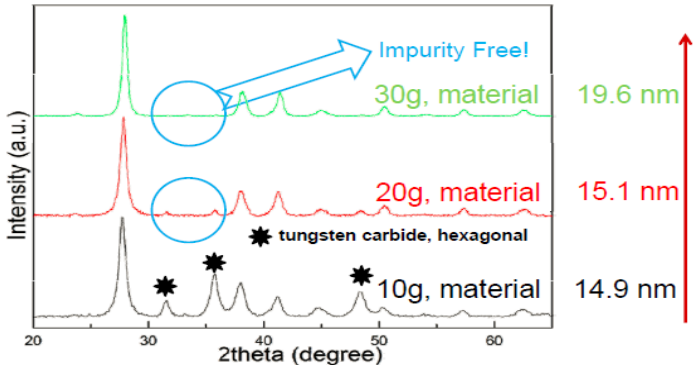


Sample Information	Reaction Temperature (℃)	Reaction Time (s)
Sample 1	35	30
Sample 2	35	60
Sample 3	75	60
Sample 4	115	60
Sample 5	155	60

Thermal conductivity of pellets







Impact

- Synthesis of impurity-free Bi_2Te_3 nanocrystals with sizes down to 4nm and various morphologies.
- Significantly reduced thermal conductivity in nanostructured bulk samples hot pressed from Bi_2Te_3 nanocrystals.

Selected Publications

- L.L. Chen, Q. Zhao, and X.L. Ruan, *Materials Letters* **82**, 112-115 (2012).
- B. Qiu, L. Sun and X.L. Ruan, *Physical Review B* **83**, 035312 (2011).

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