Develop high-performance low-cost thermoelectric materials based on ultra-small Bi₂Te₃ nanocrystals.

**Objective**

Thermal conductivity, $\kappa$ of pellets, with NC size

**Approach**

Nanocrystals:
- **Bottom-up**: Wet-chemistry synthesis using the pyrolysis of organometallic compound
- **Top-down**: Ball milling of bulk materials

Wet-Chemistry Synthesis

Ball Milling

**Impact**

- Synthesis of Bi₂Te₃ nanocrystals with sizes down to 4nm and various morphologies yields low thermal conductivity $\kappa$.
- Optimizing the ligand levels within the powder can yield higher Seebeck coefficient $S$, and electrical conductivity $\sigma$, while preserving the low lower $\kappa$. This would increase $ZT$.
- The role of ligands is better understood. Such understanding is critical for scale-up production of these thermoelectric materials.

**Selected Publications**