

A novel one step synthesis and sintering of skutterudite CoSb₃

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Abstract:

Thermoelectric (TE) materials, which can be used to convert thermal energy to electric energy, have attracted a great deal of attention due to their promising applications in solid state cooling and power generation from waste heat. The production of these materials is based on a two-step procedure, first synthesis and then sintering.

Synthesis of CoSb₃ skutterudites with conventional method (furnace or ball milling) takes several days (~4 d) to obtain the final material for property measurements. Alternative routes have been proposed such as chemical routes and microwave assisted synthesis while sintering is usually been held by SPS (Spark Plasma).

In order to reduce the steps and the hours of preparation we introduce a novel way we termed RHS (Rapid Heating System). This system consists of an RF source and a mechanical press. RF has major potential and real advantages over conventional heating:

- Time and energy savings.
- Rapid heating rates (volumetric heating vs. conduction).
- Considerably reduced processing time and temperature.
- Fine microstructures and hence improved mechanical properties and better product performance.

In the proposed approach we are aiming to achieve single phase skutterudites in one step (synthesis and sintering at the same time) in less than 10 minutes, preserving the structure and the density of the materials.

X-ray diffraction analysis was used to examine the structure and the lattice parameters of the samples while SEM with EDX analysis was used to study the morphology of the compounds. We will also present data for thermoelectric properties and compare with materials synthesized with conventional approach.