Study of thermal stability of doped CoSb based skutterudites by Knudsen effusion mass spectrometry

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Study in the field of thermoelectric materials is of great importance because these materials are able to directly convert thermal energy into electrical energy (Seebeck effect, 1821; thermoelectric generator) and reversibly electrical energy into thermal energy (Peltier effect, 1835; thermoelectric heat pump or Peltier cooling). The current research, among other materials, is oriented on doped CoSb based skutterudites with high ZT-levels which can further be increased, e.g. by nano-structuring. Various ways in preparation of this kind of materials, as described e.g. in [1], [2], imply differences in thermoelectric efficiency which also depends on the thermal stability of the materials.

Thermal and phase stability of selected doped multicomponent CoSb based skutterudites from macrocrystaline to nano-structured form have been studied using methods of thermal analysis (TA) and Knudsen effusion mass spectrometry (KEMS). The measurements have been performed on a Netzsch STA 409 CD/3/403/5/G apparatus, a specially-adapted type of the commercial STA 409 CD - QMS 403/5 Skimmer Coupling Instrument, described in [3], [4]. The results of TA and KEMS measurements, including data on phase transformations and evaporation characteristics of volatile elements, supported by measurements of diffusion profiles are summarized and discussed in view of a full understanding of the degradation processes.

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