

**Characterization of electrochemically deposited thermoelectric films**  
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Thermoelectric materials provide the opportunity to generate electrical power from any source of heat production especially for applications to regenerate waste heat they are a way to save energy. Fields of application are amongst others the automotive industry or power plants.<sup>1</sup> Estimations of the automotive industry come to the anticipation of a potential energy fuel saving of 5 – 7% by the use of thermoelectric generators. Another field of application arises from the possibility to use thermoelectric materials as an energy source for sensors, which could, with an efficient design of miniaturized thermoelectric generators, be made self-sufficient. The development of the applications is restricted by the costs for their production. At the moment the materials are produced with cost-intensive sputtering techniques. The number of applications will increase as the production costs can be minimized by the use of electrochemical deposition given comparable material properties.

The physical properties of these electrochemical deposited materials depend greatly on the chemical composition, crystallinity and homogeneity of the material.<sup>ii,iii</sup> Inhomogeneities in the samples give rise to important property changes. To correlate the parameters of production with the homogeneity of the material would give a unique insight to optimize the parameters of production. Since the materials performance is greatly increased by an excess of positive or negative charge carriers the composition often is non-stoichiometric.<sup>iv</sup>

Synchrotron micro-XRF gives the opportunity to a nondestructive two and three dimensional mapping of elemental distribution of the samples. Different electrochemical deposited thermoelectrics are analyzed and the results compared to those obtained from digestion and ICP-OES. Elemental inhomogeneities are likely to result in a change of crystal structure which can be identified using micro-XRD on the same sample. Therefore, micro-XRD experiments are planned for future investigation.

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<sup>i</sup> Bell, L. E. *Science* **2008**, *321*, 1457-1461.

<sup>ii</sup> Rowe. D. W., Ed., *CRC Handbook of Thermoelectrics*; CRC Press: Boca Raton, FL.; 1995.

<sup>iii</sup> Sootsmann, J. R.; Young Chung, D. and Kanatzidis, M. G. *Angew. Chem. Int. Ed.* **2009**, *48*, 8616-8639.

<sup>iv</sup> Snyder, G. J. and Toberer, E. S. *Nature Mat.* **2008**, *7*, 105-114.