CMCC *Mechanochemistry Discussions*

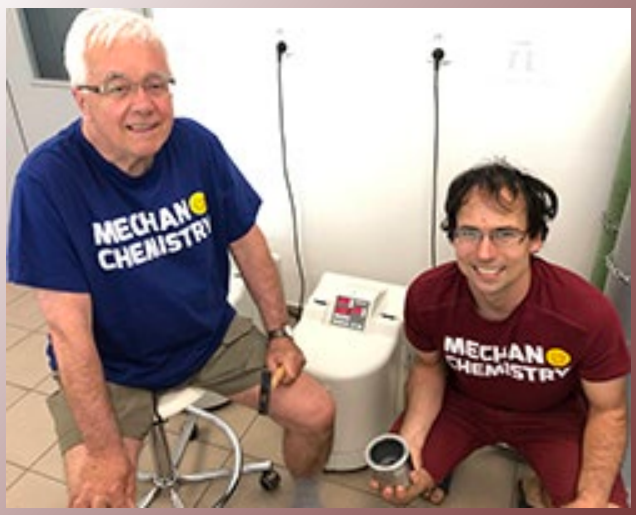
Online Seminar Series

Mechanochemistry for Current Energy and Environmental Demands: Thermoelectrics and Waste Treatment

Livestreaming at 10:00 AM (CT)

THURS., January 20, 2021

on the CMCC YouTube Channel:
https://www.youtube.com/channel/UC7eCYPKbGTKpgO7W2bNABxg



Dr. Peter Baláž & Dr. Matej Baláž

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ABSRACT:
Mechanochemical synthesis has been recently demonstrated to be an efficient way of the preparation of nanoscale thermoelectric materials. Due to the incorporation of structural disorder, defects and nanostructuring phenomenon as a result of high-energy ball milling, unique thermoelectric properties of the prepared products (after subsequent densification via, e.g., spark plasma sintering) can be achieved. Thermoelectric materials offer the viable way to generate electricity from a temperature gradient without hazardous side-products. In the majority of this talk, given by Peter Baláž, the possibility to obtain selected sulfides (namely mawsonite $Cu_6Fe_2SnS_8$, tetrahedrite $Cu_{12}Sb_4S_{13}$, chalcopyrite $CuFeS_2$ and mohite Cu_2SnS_3) using mechanochemical synthesis from elemental precursors. These sulfides represent prospective copper-based thermoelectric materials which due to their environmentally friendliness and low-cost because of high content of corresponding elements in Earth's crust. For the synthesis an industrial eccentric vibration mill was applied. The thermoelectric properties of the densified samples were measured using the standard methods for calculation of figure-of-merit ZT. This parameter combines the Seebeck coefficient and the electrical and thermal conductivity and determines the thermoelectric efficiency of material. In all the studied materials, the ZT values were comparable with the ones obtained by laboratory milling and other conventional synthetic methods. For example, the maximum ZT value in the case of mawsonite reached 0.51@623K due to very low lattice thermal conductivity.

The last part of the talk, given by Matej Baláž, will be devoted to the mechanochemical treatment of different waste materials. A monograph on this topic has been recently published by Springer-Nature [1]. A general overview of the studies covered in the monograph dealing with the high-energy ball milling of consumer, technogenic and agricultural waste will be presented and selected examples demonstrating the sustainability of mechanochemistry will be shown.

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