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Morphology–Function Relationship of Thermoelectric Nanocomposite Films from PEDOT:PSS with Silicon Nanoparticles

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Thermoelectric materials pose a compelling technology for power generation from renewable energies, since temperature gradients are transformed into voltages and thus electrical power. So far, highly efficient thermoelectrics comprise rare and/or toxic inorganic materials, and require cost- and energy-intensive fabrication. These points hinder their large-scale application.
In order to overcome these limitations, we pursue a hybrid approach combining the semiconducting polymer blend PEDOT:PSS for its high electrical conductivity and inorganic nanoparticles in order to reduce thermal conductivity within the thin film. Beside the thermoelectric properties, we investigate the thermal conductivity of pristine PEDOT:PSS and of the hybrid film, in order to ultimately calculate the figure-of-merit ZT. Through the introduction of silicon nanoparticles, we found an increase in the figure of merit ZT for intermediate nanoparticle concentrations. Grazing-incidence resonant tender x-ray scattering (GIR-TeXS) is used to derive a morphological model, and describe the influence of the nanoparticles on the thermoelectric properties.

Primary authors: Mr SAXENA, Nitin (1TU München, Physik-Department, LS Funktionelle Materialien); Mr CORIC, Mihael (Munich School of Engineering); Mr GREPPMAIR, Anton (Walter-Schottky-Institut); Dr WERNECKE, Jan (Physikalisch-technische Bundesanstalt); Mr PFLÜGER, Mika (Physikalisch-technische Bundesanstalt); Dr KRUMREY, Michael (Physikalisch-technische Bundesanstalt); Prof. HERZIG, Eva M. (Munich School of Engineering); Prof. BRANDT, Martin S. (Walter-Schottky-Institut); Prof. MÜLLER-BUSCHBAUM, Peter (Phyik-Department, Lehrstuhl Funktionelle Materialien)

Presenter: Mr SAXENA, Nitin (1TU München, Physik-Department, LS Funktionelle Materialien)

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