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In Situ Investigation of the Domain Morphology and Doping Level of Thermoelectric PEDOT:PSS Thin Films under Different Ambient Conditions

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Thermoelectric (TE) generators are considered a promising technique for heat waste recovery as they enable a direct conversion of a temperature gradient into electrical power. Especially polymer based organic thermoelectric materials, like the blend poly(3,4-ethylenedioxythiophene):polystyrene sulfonate (PEDOT:PSS), are very advantageous, as these materials allow a large scale, low-cost solution based processability of low or non-toxic, lightweight and flexible TE devices, with a wide range of applications. For improving the TE performance of PEDOT:PSS thin films, the post-treatment with ionic liquids (ILs) has turned out to be very promising, as two important TE parameters, Seebeck coefficient (S) and electric conductivity (σ), can be increased simultaneously. However, to make these IL post-treated PEDOT:PSS thin films usable in future commercial TE devices it is indispensable to also investigate the performance of these materials for their long-term stability under different ambient conditions, like elevated temperature or increased humidity. Therefore, in this work we examine the effect of different external influences on the thermoelectric properties, and correlate it with changes in the inner film morphology and oxidation level, by performing in situ GISAXS and in situ UV-vis measurements

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