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Feasible tuning of microstacking structure and oxidation level in PEDOT: PSS thin films via sequential post-treatment

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Organic semiconductors have attracted intensed attention because of their potential use in mechanically flexible, lightweight, and inexpensive electronic devices. Especially, PEDOT:PSS is the most studied conducting polymer system in thermoelectric devices due to its intrinsically high electrical conductivity, low thermal conductivity, and high mechanical flexibility. The energy conversion efficiency of a TE material is evaluated by a dimensionless figure of merit ZT and defined as ZT = S2σT/k where S is the Seebeck coefficient, σ is the electrical conductivity, T is the absolute temperature, k is the thermal conductivity, and S2σ is defined as the power factor (PF). However, it is generally considered that it is difficult to obtain a high ZT value of TE materials, due to the fact that the parameters S, σ, and k are interdependent as a function of carrier concentration and hard to be optimized simultaneously. To date, post-treatment is regarded as one promising approach to significantly enhance ZT values of PEDOT:PSS. Herein, PEDOT:PSS thin films are overcoated with salts/DMSO mixtures in order to optimize their TE performance. Subsequently, the surface morphology and the inner morphology are probed, using atomic force microscopy (AFM) and grazing-incidence wide/small-angle X-ray scattering (GISAXS/GIWAXS), respectively. Additionally, UV-Vis spectroscopy, Raman spectroscopy are used to investigate the mechanism behind for TE performance enhancement.

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