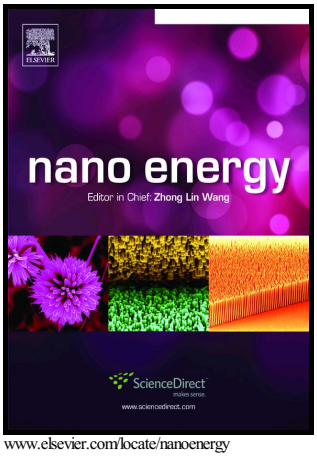

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Polymer Films with Ultrahigh Thermoelectric Properties Arising from Significant Seebeck Coefficient Enhancement by Ion Accumulation on Surface

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Abstract:

Organic thermoelectric (TE) materials have drawn great interest because of their advantages including mechanical flexibility, easy availability, non-toxicity and low thermal conductivity. TE materials with high dimensionless figure-of-merit *ZT* are required for highly efficient TE conversion. But the electrical conductivity and Seebeck coefficient of TE materials are interdependent. The increase in Seebeck coefficient is usually at the cost of the decrease in electrical conductivity. In this work, we report a facile approach to significantly enhance the TE properties of poly(3,4-ethylenedioxythiophene):poly(styrene sulfonate) (PEDOT:PSS) films by ion accumulation of an ionic liquid on the polymer surface. The ion accumulation can increase the Seebeck coefficient of the PEDOT:PSS films by 1.2-2 fold while it does not remarkably affect the electrical conductivity. The PEDOT:PSS films can exhibit an ultrahigh power factor of 754 $\mu W\ m^{-1}\ K^{-2}$, corresponding to a *ZT* value of 0.75. This *ZT* value is comparable to that of inorganic TE materials like bismuth telluride at 300 K.

Graphic Abstract