Studies on the thermoelectric properties of PEDOT/PSS

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Thermoelectric devices are promising candidates for harvesting waste heat and solar thermal energy. Previous studies of thermoelectric materials have mainly investigated inorganic materials such as bismuth-telluride. Most of these inorganic thermoelectric materials show their optimum performance at temperatures higher than 200 °C. However, there is a huge amount of waste heat that is at temperatures lower than 150 °C. At such low temperatures, the energy conversion efficiency is low because of the small achievable temperature difference suggested by the Carnot cycle. To harvest huge amount of thermal energy available at low temperatures, ideal materials should be cheap to produce, flexible, and suitable for large-area fabrication. Organic semiconductors meet these requirements.

The thermoelectric properties of PEDOT-based materials have attracted attention because of their remarkable electrical conductivity.[1-3] In this presentation, we will report detailed studies on the thermoelectric properties of bench-mark conducting polymers PEDOT:PSS. The anisotropic electrical and thermal conductivity[4], and the humidity dependent thermoelectric properties[5] of PEDOT:PSS will be discussed. We will also describe our work on improving the thermoelectric properties of PEDOT-based materials and improving the power output of thermoelectric modules by using PEDOT[6-7].

References

[1] Q.S. Wei, M. Mukaida, Y. Naitoh and T. Ishida, *Adv. Mater.*, **2013**, 25, 2831.

[2] Q.S. Wei, M. Mukaida, K. Kirihara, Y. Naitoh and T. Ishida, *Materials, **2015**, 8, 732.*

[3] Q.S. Wei, M. Mukaida, K. Kirihara, Y. Naitoh and T. Ishida, *submitted*

[4] Q.S. Wei, M. Mukaida, K. Kirihara, and T. Ishida, *ACS Macro Lett.*, **2014**, 3, 948.

[5] Q.S. Wei, M. Mukaida, K. Kirihara, Y. Naitoh and T. Ishida, *Appl. Phys. Express*, **2014**, 7, 031601.

[6] Q.S. Wei, M. Mukaida, K. Kirihara, Y. Naitoh and T. Ishida, *RSC Adv., **2014**, 4, 28802.*

[7] Q.S. Wei, Y. Sugihara, T. Tanabe, M. Mukaida, K. Kirihara, Y. Naitoh and T. Ishida, *Polymer*, **2015**, 66, 38.