



Fabrication of conducting polymers from thio-based small molecules and noble metals for thermoelectric applications

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Abstract

Conducting polymers (CPs) have been studied for thermoelectric applications, mainly due to its intrinsic advantages, including easy fabrication, light density and large process-ability. In this area, many conducting polymers synthesized from thiophene, aniline, 3,4-Ethylenedioxythiophene (EDOT) and others have been reported. Most of these polymers are synthesized from one phase chemical reaction. During the synthesis of these polymers, it is very difficult to place the metallic species into the polymer structures. The rational to place metal species into the polymer structures is to enhance its carrier mobility and carrier concentration, which will tune the thermoelectric properties accordingly. In order to place the metallic species into the polymer structure, we proposed and synthesized the coordination polymers using the coordination of thio-based organic molecules and different noble metals through the interphase chemical synthesis. Such synthesis enables the coordination polymer produced at the interphase between organic phase and aqueous phase at very dilute concentration. The thermoelectric performance of the synthesized conducting polymers has been tested. The electrical conductivity can be up to 30 S/cm and the Seebeck coefficient can be up to 15 μ V/K. The common trade-off relationship between electric conductivity and Seebeck coefficient was also observed in this case. Now the efforts to tune the structure are ongoing with the tuning of metallic ions, the small thio-ligand and synthesis. In this presentation, we will share our recent findings to improve the thermoelectric performance of various coordination polymers.



Biography:

Dr Zhu Qiang obtained both his PhD degrees from the Department of Chemistry, Naitonal University of Singapore in 2010. After 2010, he worked as a senior research scientist in Albany Molecular Research Inc for 5 years. Since 2014, he joined the Institute of Materials Research and Engineering (IMRE) in Singapore. His current appointment is deputy head in the SOF department. His research focuses on utilization of specialty chemicals and Nanoparticles for different applications.



Speaker Publications:

1. Erol Y., Zhu Q., Wu G., Tan L., Xu J., Yang S., Self-Organization of PEDOT: PSS Induced by Green and Water-Soluble Organic Molecules, J. Phys. Chem. C, 2019, 123, 9745-9755.
2. Chua M., ZHU Q., XU J., Tang T., Shah K, Diversity of Electron Acceptor Groups in Donor-Acceptor Type Electrochromic Conjugated Polymers. Solar Energy Materials & Solar Cells, 2019, 197, 32-75

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