

외국 석학 초청 강연 Nanostructured Thermoelectric Materials

Presented by Huey Hoon Hng, Nanyang Technological University, Singapore

It is known that of all the primary energy we harness and use, only 30% is translated into useful work. A staggering 70% is wasted as dissipated heat during energy conversion, transportation and storage. This huge loss is itself a source of recyclable energy. If the waste heat leakage can be minimized by having the heat harnessed, stored and reused, the additional available energy can be huge. Thermoelectric (TE) devices, which can directly convert heat into electricity or vice versa, could play an important role in the energy market. TE devices can be potentially used as power generators, heat pumps, coolers and thermal sensors, which make them a unique energy harvesting and heat management system. For example, in Singapore, 42% of residential electricity is used for cooling (air conditioners), which are expected to grow at least 10% per year over the next decades. This percentage would be dramatically decreased if high-efficiency TE devices are developed to replace the traditional cooling system and realize the on-demand cooling in our daily lives (i.e. in the case of residential cooling, we can choose to only cool the chair or bed instead of the whole room). Till now, TE technology is too inefficient to be cost-effective for practical applications. Nevertheless, modern synthesis and characterization technologies are bringing TE research into a new era. In fact, the TE research area has become more promising and exciting in recent years as seen from the market forecasts for TE energy harvesters, and many companies such as BMW, have invested in TE technology. One of our research focuses is use nanostructuring to improve the TE performance of both conventional and new materials, which allows further optimization and scaling to broaden the application of TE devices. In this talk, I will focus on the various nanostructuring approaches that our group in MSE/NTU has considered to improve the performance and efficiency of various TE materials systems. I was also report on the feasibility of fabricating thin film TE device using inkjet printing, which opens up the possibility of low cost manufacturing opportunity.



Huey Hoon Hng received her B.Sc.(Hons) degree and M.Sc. in Materials Science from National University of Singapore, and later her PhD in Materials Science and Metallurgy at University of Cambridge, UK. She has been with the School of Materials Science & Engineering in NTU since 1999. She is currently the Associate Chair (Academic) for the School, and also holds the post of Director, Facility for Analysis, Characterization, Testing and Simulation (FACTS). Her research interest is in understanding the processing-microstructure-property relationships of materials. The research covers a wide range of experimental analytical techniques such as electron microscopy and X-ray diffraction analysis. Such techniques enable the characterization of nanometre scale phases and provide an in-depth understanding of the materials' properties. Her current research interest is focused on the synthesis of inorganic materials using chemical and mechanical processing techniques. The materials of interest are thermoelectric materials and materials for energy storage.

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