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Hyung Ho Park

Yonsei University, Korea

Mesoporous thermoelectric oxides

Mesoporous oxides have a structure containing nano-sized pores of 2~50 nm and are prepared by sol-gel procedure using evaporation induced self assembly. The pore size, pore distribution (regular/irregular, open/close), and pore shape can be controlled according to the synthetic process, especially with surfactant molar ratio. The existence of pores in the material grants distinctive properties such as decreased thermal conductivity from increasing phonon scattering. Therefore mesoporous oxides can be used in many applications such as thermal insulators, thermoelectrics, gas sensors, and so on. The efficiency of a thermoelectric is determined by its dimensionless figure of merit, $Z = S^2\sigma/\kappa$ where S, σ, and κ are the Seebeck coefficient, electrical conductivity, and thermal conductivity, respectively. According to this equation, good thermoelectric material should possess large power factor ($PF = S^2\sigma$) and low thermal conductivity. When introducing the pore structure, thermal conductivity can be greatly decreased but also with electrical conductivity due to electron scattering by pore structure. So, in the case of mesoporous structure adoption to thermoelectric materials, a minimum reduction in electrical conductivity while maximizing thermal isolation effect is a key issue for an enhancement in the thermoelectric property. In this presentation, various experimental approaches including a control of pore structure and introductions of dopants and nano-materials to enhance the thermoelectric property are discussed. Through the approaches, we tried to control the thermal conductivity and electrical conductivity of mesoporous oxides individually to maximize the thermoelectric property.

Biography

Hyung Ho Park is a Professor in the Materials Science & Engineering Department of Yonsei University in Korea since 1995. His research focuses on the preparation, characterization, and application of various functional thin films including nano-particle preparation, nano-hybridization, and nanostructure formation. Nano-hybrid thin films are prepared by the incorporation of nano-particles or *in situ* one-pot synthesis. Nanostructure formation involves nano-particle distribution in TCO and organic conductors and the control of nano-pore size and distribution in mesoporous thin films. He has published more than 380 SCI(E) papers in reputed journals and has been serving as an Editorial Board Member of more than 5 journals.

hhpark@yonsei.ac.kr

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