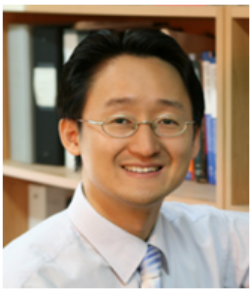
SEMINAR SERIES

International Institute for Carbon-Neutral Energy Research
Kyushu University

Title Nano-carbon incorporated composites for stretchable electronics and thermoelectric power generation



Speaker Prof. Seunghyun Baik
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Korea

Date & Time Friday, October 21, 2016 4:00 p.m.
Place I²CNER Hall, Ito campus, Kyushu University

Abstract

The nano-carbon incorporated composites have been investigated in my lab in two different applications: stretchable electronics and thermoelectric power generation. The first part of the talk addresses stretchable conductive composites. They are typically composed of conductive fillers and stretchable polymer matrix. Carbon nanotubes have been actively investigated for conductive fillers due to the excellent electrical and thermal properties. However, the high electrical/thermal conductivity of bulk composites could not be realized by carbon nanotubes alone. Here we present multi-dimensional filler design to dramatically enhance electrical and thermal transport properties in various forms of polymer matrix composites. 1-D multi-walled carbon nanotubes with high aspect ratios constructed effective percolation network between 2/3-D micro-scale silver particles, and the contact was improved by 0-D silver nanoparticles pre-functionalized on the surface of nanotubes. A new design of conductive fillers, silver nanoflowers, will also be introduced.

The second part addresses thermochemical reaction control and thermoelectric power generation. The thermochemical reaction of surface-adsorbed fuel could be controlled by anisotropic thermal properties of 1-D or 2-D carbon nanomaterial substrates. The exothermic chemical reaction inevitably induced steep temperature gradient at the reaction front generating thermopower waves. However, the small Seebeck coefficient of carbon nanotubes limited the induced maximum peak voltage typically below a few hundred millivolts. We hybridized nano-carbon materials with Sb_2Te_3 to further enhance the Seebeck coefficient, conductivity, and power factor. The thermoelectric properties of $Bi_{0.5}Sb_{1.5}Te_3$-graphene bulk composites and recent progress in thermopower waves achieving a very high peak voltage (> 5V) will also be introduced.

About the Speaker

Prof. Seunghyun Baik has worked at School of Mechanical Engineering at Sungkyunkwan University (SKKU) since 2004. He is also jointly affiliated at the Institute for Basic Science program at SKKU. He received his Ph.D. at Department of Mechanical Engineering at University of Wisconsin-Madison in 2001. He worked at Department of Chemical and Biomolecular Engineering at University of Illinois-Urbana-Champaign as a postdoctoral researcher (2001-2004). His recent research interests include energy, membrane, and conductive composite applications of carbon/silver nanomaterials.

Host: Prof. Naotoshi Nakashima

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