

School Seminar (2015-30)

School of Materials Science & Engineering

“Materials Innovation for Sustainable Growth”

Prof. Char, Kookheon

(School of Chemical and Biological Engineering,
Seoul National University)

2015. 12. 07. (Mon.) 17:00
APRI 1F, Auditorium Hall

Materials Innovation for Sustainable Growth

Kookheon Char

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With ever-increasing human population, depleting natural resources, and rapid climate change confronting humanity, the role of materials science and engineering is becoming more crucial in addressing these issues and establishing systems for sustainable growth. Herein, recent efforts in our research center (National CRI Center for Intelligent Hybrids), utilizing both organic and inorganic material design and synthesis, to address key issues to such an end are described. Firstly, we have established a novel method to prepare well-defined nanocrystals and their hybrid systems. The hybrid materials, combined with the ease of processing, can efficiently down-convert the short wavelength light to the wavelengths which are known to lead to optimal uptake and grown in crops. Secondly, we have established novel chemical methods for the direct utilization of elemental sulfur. More than seven million tons of elemental sulfur are produced in excess each year and are stockpiled in landfill-like deposits in remote areas. While elemental sulfur is known to be environmentally benign, the sheer volume of it left unused is a major emerging issue in the petrochemical industry.

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Education/Career:

- 2010-present** Director, The National Creative Research Initiative Center for Intelligent Hybrids
- 1991-present** Professor, Seoul National University (Korea)
- 1989-1990** Visiting Scientist, IBM Almaden Research Center (USA)
- 1989** Ph.D., Chemical Engineering, Stanford University (USA)
- 1983** M.S., Chemical Engineering, KAIST (Korea)
- 1981** B.S., Chemical Engineering, Seoul National University (Korea)

Research Interests:

Intelligent Hybrids & Devices, Directed & Self Assembly, Polymer Thin Films, Hierarchical Structures

Representative Publications:

1. J. Kwak, J. Lim, M. Park, S. Lee, K. Char, C. Lee, "High-Power Genuine Ultraviolet Light-Emitting Diodes Based on Colloidal Nanocrystal Quantum Dots", *Nano Lett.* **15**, 3793-3799 (2015).
2. Y. Jang, H. Lee, K. Char, J.-M. Nam, "Transparent, Nanoporous and Transferable Membrane-Based Cell-Cell Paracrine Signaling Assay", *Adv. Mater.* **27**, 1893-1899 (2015).
3. J. Lim, J. Pyun, K. Char, "Recent Synthetic and Processing Approaches for the Direct Use of Elemental Sulfur for Advanced Materials", *Angew. Chem. Int. Ed.* **54**, 3249-3258 (2015).
4. W. K. Bae, J. Lim, D. Lee, M. Park, H. Lee, J. Kwak, K. Char, C. Lee, S. Lee, "R/G/B/Natural White Light Thin Colloidal Quantum Dot-Based Light-Emitting Devices", *Adv. Mater.* **26**, 6387-6393 (2015).
5. S. Wooh, J. H. Koh, S. Lee, H. Yoon, K. Char, "Trilevel-Structured Superhydrophobic Pillar Arrays with Tunable Optical Functions", *Adv. Funct. Mater.* **24**, 5550-5556 (2014).
6. L. J. Hill, N. E. Richey, Y. Sung, P. T. Dirlam, E. Lavoie-Higgins, I.-B. Shim, N. Pinna, M.-G. Willinger, W. Vogel, J. J. Benkoski, K. Char, J. Pyun, "Colloidal Polymers from Dipolar Assembly of Cobalt-Tipped CdSe@CdS Nanorods", *ACS Nano* **8**, 3272-3284 (2014).
7. W.-G. Bae, S. M. Kim, S.-J. Choi, S. G. Oh, H. Yoon, K. Char, K. Y. Suh, "In Situ Realization of Asymmetric Ratchet Structures Within Microchannels by Directionally Guided Light Transmission and Their Directional Flow Behavior", *Adv. Mater.* **26**, 2665-2670 (2014).
8. J. Lim, M. Park, W. K. Bae, D. Lee, S. Lee, C. Lee, K. Char, "Highly Efficient Cadmium-Free Quantum Dot Light-Emitting Diodes Enabled by the Direct Formation of Excitons Within InP@ZnSeS Quantum Dots", *ACS Nano* **7**, 9019-9026 (2013).
9. S. Wooh, Hyunsik Yoon, Jae-Hyun Jung, Yong-Gun Lee, Jai Hyun Koh, Byoungho Lee, Yong Soo Kang, and Kookheon Char, "Efficient Light Harvesting with Micropatterned 3D Pyramidal Photoanodes in Dye-Sensitized Solar Cells", *Adv. Mater.* **25**, 3111-3116 (2013).
10. W. J. Chung, J. J. Griebel, E. T. Kim, H. Yoon, A. G. Simmonds, H. J. Ji, P. T. Dirlam, R. S. Glass, J. J. Wie, N. A. Nguyen, B. W. Guralnick, J. Park, Á. Somogyi, P. Theato, M. E. Mackay, Y.-E. Sung, K. Char, J. Pyun, "The Use of Elemental Sulfur as an Alternative Feedstock for Polymeric Materials", *Nature Chem.* **5**, 518-524 (2013).