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CV/ biography

J. Kim did his undergraduate study at KAIST (2006), master study at Ecole Central Paris (2009), and PhD at Ecole Polytechnique (2013) on the topic of '*Colloidal dynamics of luminescent anisotropic nanocrystals*'. Then he did a post-doctoral research at Lawrence Berkeley National Laboratory (LBNL) (2014~2015) and Univ. of Texas at Austin (2015) on the topic of '*Plasmonic semiconductor nanocrystals and their application to electrochromic smart windows*'. Since 2016, he has been continuing his professional career at the condensed matter physics lab (LPMC) at Ecole Polytechnique. He is developing both the chemical synthesis of various types of nanocrystals and their *in-situ* micro-spectroscopy in biomedical environments and for applications to sustainable energy.

Tailoring Anisotropies in Nanocrystals

Recent nanocrystal research has discovered the new material properties emerging from size, shape, surface, and interface, which provided a variety of novel functionalities in high-tech devices. Contrarily, the principal impacts of the intrinsic structure of materials, especially the anisotropic physico-chemical properties, are more and more underestimated. Many of the profound earlier studies on bulk materials are overlooked while investigating the same compositions in nanoscale. Such a tendency limits rational understanding of the nanomaterials and their benefits.

In this presentation, it will be discussed the strategies to redesign anisotropic nanomaterials for their nano-properties and intrinsic properties to synergistically collaborate in order to achieve unprecedented functionalities. As a first example, plasmonic semiconductor nanocrystals are presented. The localized surface plasmon resonance (LSPR), commonly investigated with metal nanoparticles, has been controlled with the particle size and shape. Instead of metal, we use semiconductor that allows to synthetically tune the doping level and the structure of matrix. By deliberately controlling the crystal phase and morphology of the semiconductor nanocrystals, we achieve a wide spectral range (from VIS to IR) and post-synthetic modulation of LSPR [1,2]. The second example is the anisotropic rare-earth phosphor nanocrystals. Rare-earths are extensively used for energy sustainability (e.g. windmills, electric cars, batteries, catalysts, and lightings). Their unique properties originate from the protected *f*-orbital electrons so that the bulk properties are unchanged even in nanoscale. We combine such a stability of the polarized rare-earth luminescence with the dynamic behavior of anisotropically shaped nanocrystals. As-designed rare-earth nanocrystal phosphors can be used to monitor complex motions of micro-biosystems and also for microfluidic analysis essential for health care [3,4].

[1] Nano Lett. 15, 5574-5579 (2015)
[2] Nano Lett. 16, 3879-3884 (2016)
[3] Nature Nanotechnology. 12, 914-919 (2017)
[4] JACS. 140, 9512-9517 (2018)

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