Zhifeng Huang, J Nanomater Mol Nanotechnol 2019, Volume 8
DOI: 10.4172/2324-8777-C3-062

Chiral Nanoparticles with Sub-10 nm Pitch: Fabrication, Characterization and Applications

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Metallic helices with a characteristic helical pitch (P) in the micro- or nano-scale have been proposed for diverse chirality-related primary applications. However, limited development of nanofabrication techniques leads to P >20 nm; molecules are too small in size to effectively perceive the helical chirality, and such the dimensional mismatch will substantially prohibit the development of those applications. In this talk, I will device a method to tackle this fundamental problem. Without usage of chiral ligands, glancing angle deposition with fast substrate rotation is performed to produce chiral nanoparticles (CNPs) that have sub-10-nm P (as small as 2 nm) and are composed of controllable plasmonic materials and helicity. Galvanic replacement reaction of CNPs enable the fabrication of mesoporous CNPs. CNPs are used to induce enantiospecific adsorption of molecules, mediate the enantiopreferential photocyclodimerization of 2-anthracenecarboxylic acid, and markedly enhance optical activity of chiral molecules in roughly one order of magnitude. These studies will pave the way to developing CNPs for significant chirality-related applications, such as heterogeneous asymmetric catalysis and sensitive detection of absolute configuration of enantiomers that is practically desired by the production of single-enantiomer drugs.

Biography

Dr. Zhifeng Huang obtained Ph.D. in Science and Engineering of Materials at Arizona State University (US, 2007), and currently is tenured Associate Professor at Hong Kong Baptist University. He is devoted to fabricating sculptured nano thin films to study chiral nanoplasmonics, surface enhanced chiroptical spectroscopies, enantioselective synthesis, photochirogenesis, enantiodifferentiation, trace (bio)molecular detection, bio-nano interaction, specific differentiation of stem cells, functional optic coating, and flexible/wearable energy generation and storage. He contributed to two book chapters, and published his studies in Nat. Nanotechnol., Annu. Rev. Phys. Chem., Adv. Mater., Adv. Funct. Mater., Nano Lett., J. Am. Chem. Soc., Small, Nanoscale, and so on.

Dr. Huang was presented Gold Medal with Congratulations of Jury (The 46th International Exhibition of Inventions of Geneva, 2018), Outstanding Research Achievement (APSMR, 2017 and 2018), the Prof. Rudolph A. Marcus Award 2016, the Incentive Award for Outstanding Research Achievement (Faculty of Science, HKBU, 2015), and National-level Technology Project Award for Advanced Individual (2012, 2014). He is serving as an Associate Editor for Science Advances Today and Science Letters Journal (Cognizure). He, together with Prof. Ken Yung (Department of Biology, HKBU), co-founded a spin-off, Mat-A-Cell Ltd., to commercialize a new-generation medical device for developing cell therapies.

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