

# 제 69회

# ORGAN ON A CHIP

# 기술교류회

2021.05.13 목 오후 4시 30분

한림대학교 SmartLEAD 온라인 강연



현택환 교수

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## 1. Education

박사: Univ. of Illinois, 무기화학 (1996)

석사: 서울대학교, 화학과 (1989)

학사: 서울대학교, 화학과 (1987)

## 2. Experience

서울대학교 공과대학 화학생명공학부, 석좌교수

기초과학연구원 (IBS) 나노입자연구단, 단장

미국화학회지 (JACS), Associate Editor

2020 Citation Laureate in Chemistry (Nobel Prize watch-list)

제목

## 나노소재의 합성과 에너지와 의료분야 응용 Chemistry for Nano, and Nano for Medicine & Energy

초록

For the last 20 years, I have been focused on the synthesis and medical & enegy applications of uniform-sized nanocrystals and related nanomaterials (*Nature Mater.* **2004**, 3, 891). We reported that uniform 2 nm iron oxide nanoclusters can be successfully used as T1 MRI contrast agent for high-resolution MR angiography of monkeys (*Nature Biomed. Eng.* **2017**, 1, 637). We demonstrated that ceria nanoparticles and ceria-zirconia nanoparticles can work as therapeutic antioxidants to treat various nasty diseases including ischemic stroke, Alzheimer's disease, sepsis, and Parkinson's disease (*Angew. Chem. Int. Ed.* **2012**, 51, 11039; *ACS Nano*, **2016**, 10, 2860; *Angew. Chem. Int. Ed.* **2017**, 56, 11399; *Angew. Chem. Int. Ed.* **2018**, 57, 9408; *Adv. Mater.* **2018**, 30, 1807965). CeO<sub>2</sub>/Mn<sub>3</sub>O<sub>4</sub> nanocrystals possessing surface strains protect tissue-resident stem cells from irradiation-induced ROS damage, significantly increasing the survival rate of the animals (*Adv. Mater.* **2020**, 32, 2001566). We report a highly sensitive and selective K<sup>+</sup> nanosensor that can quantitatively monitor extracellular K<sup>+</sup> concentration changes in the brains of freely moving mice experiencing epileptic seizures (*Nature Nanotech.* **2020**, 15, 321).

We present a synthesis of highly durable and active electrocatalysts based on ordered fct-PtFe nanoparticles and FeP nanoparticles coated with N-doped carbon shell (*J. Am. Chem. Soc.* **2015**, 137, 15478; *J. Am. Chem. Soc.*, **2020**, 142, 14190; *J. Am. Chem. Soc.* **2017**, 139, 6669). We also report on the design and synthesis of highly active and stable Co-N<sub>4</sub>(O) moiety incorporated in nitrogen-doped graphene (Co<sub>1</sub>-NG(O)) that exhibits a record-high kinetic current density (2.84 mA cm<sup>-2</sup> at 0.65 V vs. RHE) and mass activity (277.3 A g<sup>-1</sup> at 0.65 V vs. RHE) with unprecedented stability (>110 h) for electrochemical hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) production (*Nature Mater.* **2020**, 19, 436). We report on the design and synthesis of highly active TiO<sub>2</sub> photocatalysts incorporated with site-specific single copper atoms (Cu/TiO<sub>2</sub>) that exhibit reversible & cooperative photoactivation process, and enhancement of photocatalytic hydrogen generation activity (*Nature Mater.* **2019**, 18, 620). We synthesized multigrain nanocrystals consisting of Co<sub>3</sub>O<sub>4</sub> nanocube cores and Mn<sub>3</sub>O<sub>4</sub> shells. At the sharp edges of the Co<sub>3</sub>O<sub>4</sub> nanocubes, we observed that tilt boundaries of the Mn<sub>3</sub>O<sub>4</sub> grains exist in the form of disclinations, and we obtained a correlation between the defects and the resulting electrocatalytic behavior for the oxygen reduction reaction (*Nature* **2020**, 359, 577).

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