

## **Yuan-Yao Li 李元堯**

Dean of College of Engineering

Distinguished Professor of Department of Chemical Engineering

National Chung Cheng University

### **Education and Professional Position**

1998            Ph.D., Chemical Engineering, University of Bath, UK  
1998-2001    Postdoctoral Associate, University of Tokyo, Japan  
2001-2006    Assistant Professor, Chem. Eng., National Chung Cheng University  
2006-2009    Associate Professor, Chem. Eng., National Chung Cheng University  
2009-present Professor, Chem. Eng., National Chung Cheng University  
2018-2019    Visiting Scholar, Chemistry, Stanford University, USA

### **Research Interests**

Carbon nanomaterials, electrocatalysts, single atom catalysts, metal-air batteries, metal-ion batteries, fuel cells.

### **Publications**

Published more than 120 SCI papers in esteemed journals, including Nature, Advanced Materials, Nature Communications, Chemical Engineering Journal, JACS, and PNAS. Google scholar: H-index: 40 and i10 index: 90.

## Na/Cl<sub>2</sub> and Li/Cl<sub>2</sub> batteries

### **Abstract**

Sodium is a promising anode material for batteries due to its low standard electrode potential, high abundance and low cost. In this work, we report a new rechargeable ~ 3.5 V sodium battery using Na anode, high-microporosity carbon-nanosphere cathode and a starting electrolyte comprised of AlCl<sub>3</sub> in SOCl<sub>2</sub> with fluoride-based additives. The battery, exhibiting ultrahigh ~ 2800 mAh/g first discharge capacity, could 1 cycle with a high reversible capacity up to ~ 1200-1860 mAh/g at 3.5 V and an average coulombic and energy efficiency up to > 99% and ~ 93%, respectively. Through battery cycling, NaCl and other chlorine species are produced that supported anode's Na/Na<sup>+</sup> redox and cathode's chloride/chlorine redox. Fluoride-rich additives were important in forming a solid-electrolyte interface, affording reversibility of the Na anode for a new class of high capacity secondary Na battery. The same concept also led to a rechargeable Li/Cl<sub>2</sub> battery.