

Ru@Pt and Au@Pt Core-Shell Electrocatalysts: Effect of Core Element, Size, Shape, and Pt Coverage

YuYe Tong

Department of Chemistry, Georgetown University, Washington DC 20057, USA

E-mail: yyt@georgetown.edu

Pt has long been used as the major component of both anode and cathode electrocatalysts for hydrogen or methanol (MeOH) electro-oxidation and oxygen reduction reaction (ORR) in low-temperature fuel cell applications. However, the CO poisoning of the anode during the hydrogen or MeOH electro-oxidation and the notoriously sluggish ORR on the cathode are the two main reasons responsible for the large cell potential losses. Consequently, the high Pt loading is needed in both the anode and cathode to sustain the desired fuel cell performance. Numerous efforts have been made to improve the CO tolerance, to accelerate kinetically the ORR, and by which to reduce Pt loading thus the cost. For these purposes, many binary or ternary Pt-based metallic/metal oxide catalysts have been studied, and among which, PtRu and PtAu bimetallic systems have drawn much attention. In this presentation, we will discuss a rather detailed comparative investigation of the electrocatalytical properties of nanoscale Ru@Pt and Au@Pt core-shell electrocatalysts as functions of the core element, size, shape, as well as the Pt coverage. We will demonstrate how these parameters influence the respective catalytic activity of the core-shell electrocatalysts and how it can be finely tuned by varying these parameters.

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Bio Sketch

Dr. YuYe Tong was educated in China and Switzerland: He obtained his BS in Nuclear Physics and MS in Nuclear Physics/Physical Chemistry at Fudan University, Shanghai, China in 1983 and 1986 respectively, and his Ph. D in experimental condensed matter physics in 1994 at the Federal Institute of Technology, Lausanne, Switzerland. He was a visiting staff scientist at the Institut de Recherches sur la Catalyse, CNRS (Centre Nationale de Recherches Scientifique), Villeurbanne, France from 1995 to 1996, and a research associate, then a senior research associate at the Department of Chemistry, University of Illinois at Urbana-Champaign from 1996 to 2001. He joined the Department of Chemistry as an assistant professor in 2001 and was promoted to associate professor in 2006. His research interests focus on metal nanoparticles that include their synthesis, surface engineering, nanoscale charge transfer, and applications in fuel cell electrocatalysis and nanoelectronics. He is a world-leading expert in nuclear magnetic resonance (NMR) of metal nanoparticles and in situ electrochemical NMR. His research is currently supported by both NSF-CHE and DOE-BES.