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Insoluble discharge formation in the air cathode of Li-Air batteries

Low energy capability as opposed to fossil fuels remains as a major hurdle to battery development. Metal-oxygen batteries are attractive due to the absence of active cathode material, i.e. oxygen, in energy storage devices. Metal materials such as Fe, Zn, Al, Mg, Ca, Li, etc. have been researched for metal-oxygen batteries. Among them, Li-air batteries show a promising potential of high specific energy storage due to use of lithium metal which is light in weight. Bruce et al. reported theoretical values of 3505 Wh kg⁻¹ and 3582 Wh kg⁻¹ for non-aqueous and aqueous electrolytes, respectively. These values are comparable to those of direct methanol fuel cells (DMFC) (5524 Wh kg⁻¹) and gasoline engine (11,860 Wh kg⁻¹). Its capacity at current stage of Li-air battery development, however, is still much less than the theoretical values. Several major factors are responsible for the limited actual capacity, such as electrolyte consumption and precipitation of lithium oxides inside electrode's pore structure. In this talk, we present analysis of air cathode performance, taking into account both electrode passivation and transport resistance raised by insoluble products. Both effects are theoretically evaluated and compared. Validation is carried out against experimental data under low currents. The effects of electrode pore structure, such as porosity and tortuosity, on both the influence of insoluble precipitates and discharge capability are investigated.

Biography

Yun Wang received his BS and MS degrees from Peking University in 1998 and 2001, respectively. In 2001, he went to the Pennsylvania State University where he obtained his PhD degree in Mechanical Engineering in 2006. Right after his PhD study, he joined the Mechanical and Aerospace Engineering Faculty at the University of California, Irvine. In 2012, he was promoted as Associated Professor. He is currently the Director of the Renewable Energy Resources Lab with research focuses on PEM fuel cell, new battery, microfluidics, and thermal transport.

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