Ion Irradiation Effects on Structural and Electrochemical Charge Storage Properties of Electroceramic Materials for Lithium-Ion Batteries

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Abstract

Increasing demands call for future lithium-ion batteries (LIBs) to offer increased energy and power density, improved safety, longer lifetime, and lower cost. As a result, recent studies have investigated enhanced electrochemical charge storage in electrodes that contain intentional structural defects (e.g. vacancies, interstitials). In this talk, I will introduce our work on a novel approach to introduce defects in electrode materials via ion irradiation, which is known to produce an excess of defects in a material. In this work we investigate the irradiation effect on structure and electrochemical response of TiO_2 nanostructured thin films through proton ion irradiation. In addition, we investigated heavy ion irradiation on TiO_2 single crystals to elucidate the effects of irradiating species and crystallographic orientation on defect production and microstructure evolution. We have observed defect generation upon irradiation in both nanostructured and single crystal TiO_2 samples and investigated the relationship between irradiation-induced defects and the electrochemical properties of the TiO_2 samples.

Dr. Hui (Claire) Xiong is an Associate Professor in the Micron School of Materials Science and Engineering at Boise State University. Dr. Xiong received a BE in Applied Chemistry, MS in Inorganic Chemistry from East China University of Science and Technology, and a PhD in Electroanalytical Chemistry from the University of Pittsburgh. Between 2008 - 2012, she conducted postdoc work at Harvard University and Argonne National Laboratory where her research involved electrochemical characterization of micro-fabricated cathode materials for micro-solid oxide fuel cells and the development of novel nanostructured electrode materials for rechargeable batteries. Xiong received the NSF CAREER Award in 2015 and is the Scialog Fellow for Advanced Energy Storage. Her research interests include design and development of nanoarchitectured and defect-driven electrode materials, mechanistic insights on electrolyte degradation, and ion irradiation effects on electrode materials for energy storage systems including Li-ion and Na-ion batteries.