LEHIGH UNIVERSITY

Fall '17 Seminar Series

Department of Materials Science and Engineering

Applications of Atomic Layer Deposition in Solar Fuel Synthesis

Dr. Paul C. McIntyre
Stanford University
September 19, 2017--- 4:10 p.m. --- WH 303

Abstract

Atomic layer deposition (ALD), a cyclic form of chemical vapor deposition which occurs via a series of self-limiting chemisorption reactions, is increasingly used in fabricating microelectronic devices because of its remarkable potential for depositing a very wide range of thin films of well-controlled thickness and uniformity over a large variety of substrates. Exciting applications of ALD in energy technologies have also emerged in recent years, particularly in photovoltaics and micro-fabricated solid oxide fuel cells. In this presentation, I will summarize recent research in which ALD has been used to prepare stable photoelectrodes for efficient solar-driven water splitting to create hydrogen fuel. ALD-grown TiO_2 layers are found to be particularly effective in inhibiting oxidative corrosion of high-quality semiconductor absorbers and in electronically coupling these semiconductors to efficient catalysts for oxygen evolution, the kinetically-limiting step in water splitting. This talk will describe factors influencing the electronic conductivity of ALD-TiO_2, and design principles for optimizing the photovoltage of these protected semiconductor junctions. Atomic layer deposition of TiO_2-transition metal oxide alloy layers that can function as efficient oxygen evolution catalyst layers and high work function Schottky contacts for water splitting photoanodes will also be reported.

Biography

Paul McIntyre is Rick and Melinda Reed Professor in the School of Engineering, Chair of the Department of Materials Science and Engineering and Senior Fellow of the Precourt Institute for Energy at Stanford University. He was previously Member of the Technical Staff of the central research laboratories of Texas Instruments, and was a Director's-Funded Postdoctoral Fellow at Los Alamos National Laboratory. At Stanford, McIntyre leads a research team of graduate students, postdoctoral researchers and adjunct professors who perform basic studies of nanostructured inorganic materials for applications in electronics and energy technologies. He is best known for his work on metal oxide/semiconductor interfaces, functional metal oxide thin films, atomic layer deposition, and semiconductor nanowires. McIntyre is an author of approximately 220 archival journal papers and an inventor of 8 US patents. He has given over 120 invited presentations, plenary talks and tutorial lectures on these topics. He has received two IBM Faculty Awards, a Charles Lee Powell Foundation Faculty Scholarship and an SRC Inventor Recognition Award. McIntyre was a GCEP Distinguished Lecturer in 2010 and received the Woody White Award of the Materials Research Society in 2011. In 2016, he was the inaugural Colorado School of Mines/NREL Materials Science Distinguished Lecturer.

Refreshments served at 3:45 p.m. in Student Lounge – Whitaker 349
Attendance is required of all full-time MSE Graduate Students.
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