

**MATERIALS SCIENCE AND ENGINEERING (MS&E) SEMINAR SERIES**  
**Friday December 6, 2019 at 3:00pm in room ESB 207**

**“Controlling polar domains on oxide surfaces to optimize photochemical reactivity”**

**Prof. Gregory S. Rohrer Head of the Department of Materials Science and Engineering at Carnegie Mellon University**

Abstract: For many years, researchers have sought metal oxide catalysts that efficiently split water in sunlight to produce hydrogen fuel. On the surfaces of oxide semiconductors with polar domains, electrons are attracted to positively terminated domains where they promote reduction reactions and holes are attracted to negatively charged domains where they promote oxidation. The separation of charge carriers reduces charge carrier recombination and the back reaction of the reduced and oxidized products. Charged domains can arise at the surfaces because of piezoelectricity, flexoelectricity, or differences in the chemical termination of the surface. Here, we report results showing that it is possible to optimize the overall photochemical reactivity of SrTiO<sub>3</sub> and BaTiO<sub>3</sub> by controlling relative areas of the polar surface regions and the surface charge through solution pH. We will also describe a new high throughput method to study the rate of hydrogen production from BaTiO<sub>3</sub>, SrTiO<sub>3</sub>, and TiO<sub>2</sub>/BaTiO<sub>3</sub> heterostructured catalysts as a function of materials and reaction parameters. For the single phase catalysts, we have found that the surface charge and solution pH are important parameters for optimizing reactivity. For the heterostructured catalyst, the crystallization temperature is critical for balancing the compromise between surface area and crystallinity.

Biography: Prof. Gregory S. Rohrer received his Bachelors degree in Physics from Franklin and Marshall College, his Doctoral degree in Materials Science and Engineering from the University of Pennsylvania, and joined the faculty at Carnegie Mellon in 1990, where he is now the W.W. Mullins Professor and Head of the Department of Materials Science and Engineering. Prof. Rohrer has authored or co-authored more than 300 publications. Prof. Rohrer is a fellow of the American Ceramic Society and his research has been recognized by a number of awards including the Richard M. Fulrath Award, the Robert B. Sosman Award, and the W. David Kingery Award, all of the American Ceramic Society. In 2011, he served as chair of the University Materials Council. Rohrer is a former member of the Board of Directors of the American Ceramic Society and is an editor of Acta Materialia.

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