



# Department of Chemical and Biomolecular Engineering



**Seminar  
12:30 - 1:30 pm**

**141 DeBartolo Hall**

## Graduate Seminar Series

### **Heterogeneous Catalysis: Synthesis, Spectroscopy and Kinetics of Supported Metal Oxide Catalysts for Natural Gas Upgrading**

**Thursday, January 21, 2016, 12:30 pm**

**141 DeBartolo Hall**

My overarching goal is to understand the factors controlling reactivity and selectivity of supported transition metal oxide catalysts in the activation of light alkanes. In the first part of my presentation, I will highlight and explain the properties and advantages of using supported metal oxides at sub- and monolayer coverage. Then, I will discuss relevant results on the synthesis, characterization and kinetics of a library of different supported binary and ternary metal oxide catalysts, emphasizing the synergistic effects of mixed transition metal oxides at sub-monolayer and monolayer coverage in the C-H activation of gaseous alkanes. I will describe my research's journey on the oxidative dehydrogenation of propane on well-defined supported vanadium oxide catalysts to achieve the highest productivity towards propylene ( $\sim 9 \text{ Kg}_{\text{C}_3\text{H}_6}/\text{Kg}_{\text{CAT}} \cdot \text{h}$ ) and - recently - the highest vanadia dispersion on SiO<sub>2</sub> ( $\sim 9 \text{ V}/\text{nm}^2$ ) ever reported. Finally, I will show the importance of linking kinetics and - *in situ/operando* - spectroscopy to get new mechanistic insights to eventually establish quantitative structure-activity/selectivity relationships.

*Dr. Carlos A. Carrero is a postdoctoral researcher currently working with Prof. Ivo Hermans at University of Wisconsin-Madison (2014-present). Carlos has been working on crude oil, natural gas, and biomass upgrading with heterogeneous catalysts. His research is inspired by industrially attractive reactions, while at the same time he implements fundamental experiments to gather new mechanistic insights in order to improve and develop catalytic processes. Prior to his appointment at UW-Madison, he was a postdoctoral researcher in Prof. Robert Schloegl's group at the Max Planck Institute for Chemical Energy conversion in Muelheim an der Ruhr, Germany (2013-2014). Carlos obtained his Ph.D. at the Technical University of Berlin (2008-2012) tutored by Prof. Reinhard Schomaecker and Prof. Klaus-Peter Dinse. During his Ph.D., he joined the "Berlin International Graduate School of Natural Science and Engineering" (BIG-NSE), a highly respected catalysis school. Carlos is originally from Venezuela, where he completed his undergraduate studies (2005) and then joined Venezuela's oil company (2006-2008).*



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