University at Buffalo
Department of Civil, Structural and Environmental Engineering
School of Engineering and Applied Sciences

Environmental and Water Resources Engineering Seminar

Rational Design of Catalytic and Hydrocarbon Materials to Meet Automotive Emissions Regulations

Abstract

Emission legislation for vehicle pollutants is becoming more stringent worldwide due to increasing concerns of the impact of air pollution on both the environment and public health. New and improved catalysts have a major role to play in the development of methods to treat automobile exhausts for the regulated emissions during the engine cold start. However, significant technical barriers exist for implementing novel catalytic materials into practice. In the first part of this talk, I will present my previous research work on achieving better control over the structure and composition of catalytic metal particles and the nature of the support that largely influences the performance of supported metal catalysts. Synthetic routes based on the use of poly(amidoamine) dendrimers as templating agents and a simple, inexpensive Strong Electrostatic Adsorption (SEA) method are proposed. The major novelty of these synthetic approaches is that pH control helps to control the amount of metal ions complexed with dendrimers and subsequently regulates the size of metal nanoparticles formed, whereas SEA leads to the synthesis of ~ 2 nm, highly dispersed Ag/SiO_2 catalysts, extremely rare in the literature. In the second part, I will discuss the effective use of ZSM-5 and BEA zeolites to trap and retain hydrocarbons temporarily until automotive emission control catalysts are lit off. Future diesel oxidation catalysts will need to perform effectively at increasingly low exhaust temperatures arising from continued improvements in diesel engine efficiency. Thus, the potential of developing Pd-based oxidation catalysts with enhanced durability and low-temperature activity using ZrO_2-SiO_2 supports will be highlighted. Controlling morphology and accessible area of the coated ZrO_2 layer appears critical to maximize the catalytic performance.

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Dr. Eleni Kyriakidou received her BSc and MSc in Chemical Engineering in 2007 from the Aristotelian University of Thessaloniki (Greece). She, with a full graduate fellowship from the State Scholarships Foundation of Greece, completed her Ph.D. in Heterogeneous Catalysis under the supervision of Prof. Michael D. Amiridis at the University of South Carolina in 2014 (Chemical Engineering). Through her Ph.D., she became an expert in the synthesis and characterization of highly dispersed silver, rhodium and gold supported metal catalysts. During postdoctoral research in Oak Ridge National Laboratory, she developed new catalytic methods to treat automobile exhausts from cold-starting engines. Dr. Kyriakidou joined UB's Chemical and Biological Engineering Department as an Assistant Professor in January 2017. Her research focuses on important industrial targets for production of cutting-edge catalytic materials that meet the strict emission control regulations introduced by the Environmental Protection Agency using common pollutants from internal combustion engines.

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