

EECE Department Seminar

Friday, October 7, 2016

11:00am

Brauer Hall, room 12

Energy, Environmental & Chemical Engineering


Washington
University in St. Louis
SCHOOL OF ENGINEERING
& APPLIED SCIENCE

Sustainable Energy Storing Materials

ABSTRACT

ViPER (Vilas Pol's Energy Research) laboratory at Purdue University focuses efforts on the development of high capacity electrode materials and their engineering with long cycle life and improved safety. Considering the advantages and limitations of known synthesis techniques, a solvent-less, single step ViP processing technology has been developed to fabricate a variety of unique anode and cathode materials for lithium-ion, Na-ion, K-ion and Li-S batteries. The technique has particular merit for producing

carbon cavities and metal-carbon composites from inexpensive starch based precursors. This presentation will reveal selective results on the novel synthesis of 3-dimensional carbon hotels that accommodates electrochemically active, high capacity Sn, Co or Si based nanoguests. Around 300 % expansion and contraction during lithiation and delithiation of Co and Si anodes is effectively accommodated in the rooms of conducting carbon hotels minimizing pulverization effects. With the addi-

tion of electrolyte additives in Gen 2 electrolytes, high capacity and longer cycle life from these newly developed 3D electrodes are achieved. These carbon hotel rooms are also used to accommodate *in-situ* formed nanosulfur guest as a cathode of Li-S batteries in presence of fluorinated ether based electrolytes achieving longer cycle life with higher capacities. ViPER's recent efforts on structural, morphological and electrochemical properties of various electro-chemistries will be demonstrated.

Vilas Pol, PhD

Associate Professor, School of Chemical Engineering, Purdue

Prof. Vilas Pol is Associate Professor at Purdue University's School of Chemical Engineering, USA. He earned his B. Sc., M.Sc., and M. Phil. degrees from Pune University, India and Ph. D. from Bar-Ilan University of Israel. Before joining Purdue University, he was a materials scientist in the Chemical Sciences and Engineering Department at the Department of Energy's Argonne National Laboratory, IL, USA. He has 15 years of research experience in the fields of energy storage, materials science, chemistry, engineering and electrochemistry. He developed numerous synthetic approaches for the fabrication of various functional electrode materials

including anodes and cathodes of Li-ion batteries, K-ion, Na-ion and Li-S batteries. Prof. Pol's scientific breakthroughs have been featured in various media outlets including New Scientist, Discovery, Popular Science, ACS, MRS, DOE webpages and TV (NOVA, ABC7, Asia TV, and Univision) news. He has authored or co-authored more than 120 research publications (h index 34), authored 4 book chapters and an inventor on 15 US patents/applications. He is ACS Grand Prize winner, was honored with Argonne National Laboratory's distinguished 'Directors postdoctoral fellowship', MRS science as art first prize, Intel prize, Argonne's Near Hit Safety award, 2013 British Carbon Society's



Brian Kelly award and is a 'Gold Medalist' in Sports. In 2015, his sustainable materials development technology own R and D 100 award (Oscars of Invention). In 2016, he received AIChE's Sustainable Engineering Forum Research Award and his 'UpCarbon' technology is finalist for 2016 R and D 100 award.

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