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Engineered electrodes at nanoscale for energy storage devices

ViPER (Vilas Pol's Energy Research) laboratory at Purdue University focuses 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 anode1-3 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 addition 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.

Biography

Vilas G Pol is an Associate Professor at Purdue University's School of Chemical Engineering, USA. Before joining Purdue University, he was a Materials Scientist at the Department of Energy's Argonne National Laboratory, USA. He has 15 years of research experience in the fields of Energy Storage, Chemistry, Engineering and Electrochemistry. His scientific breakthroughs have been featured in various media outlets including New Scientist, Discovery, ACS, MRS and TV (NOVA, ABC7, Asia TV, and Univision) news. He has authored or co-authored 115 research publications (H index 35), authored 4 book chapters and an inventor of 15 US patents/applications. He is a recipient of many awards and honors.

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