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Room Temperature synthesized Graphene/MOPOF Nanocomposites for Low-cost Li Battery Cathodes

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Lithium ion batteries (LIBs) are the best available technology today to push forward the production of eco-friendly electric vehicles (EVs) to reduce the emission of CO₂ into the atmosphere. In addition, they are promising for efficient utilization of renewable energy sources which needs to be stored for usage. The transformation from conventional vehicles run by fossil fuels to battery powered EVs are mainly hindered by the high upfront price of the EVs which is mainly due to the high cost of the battery packs used in these vehicles. Hence, cost reduction of LIBs is one of the major strategies to bring forth the EVs to compete in the market with their gasoline counterparts. Cathode materials account for more than 40% of the total cost of LIBs and hence the cost reduction should primarily focus on alternative low cost cathode materials. In this work, Graphene/ MOPOF (Metal Organophosphate Open Framework) nanocomposites, G/K₂[(VO)₂(HPO₄)₂(C₂O₄)] with ~4 V of operation has been developed by a cost effective room temperature synthesis that eliminates any expensive post-synthetic treatments at high temperature and devoid of inert atmospheres like Ar/Ar-H₂. Though the pristine MOPOF material can undergo reversible lithium storage, it encounter capacity fading due to intrinsic poor conductivity. Enhanced lithium cycling with minimal capacity fading was witnessed with the graphene nanocomposite owing to the increased electronic conductivity and enhanced Li diffusivity. GITT studies to examine the Li ion conduction in the material revealed the good Li ion diffusion coefficients in the framework, which are of the order of some layered oxide cathodes.

References

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Biography:

Dr. M.V. Reddy obtained his Ph. D (mention with highest honours) in 2003 in from ICMCB-CNRS)/ENSCP, University of Bordeaux, France. From July 2003, he is working in National University of Singapore (NUS), Singapore. For the last 15 years, he has been working on the Li-ion battery materials (cathodes, anodes, supercapacitors and solid electrolytes), including novel methods of synthesis, characterization and evaluation of the electrochemical properties. He has published around 130 papers in various international journals and one critical review paper, and gave 58 talks (Plenary(3), keynote (3) and Invited talks(38) and 16 contributed talks) at various conferences. His h-index; 36 and over 5000 citations. He is serving as editorial advisory board member in "Materials Research Bulletin" and several other open access Journals and Societies. He served as theme chair for Energy and Environment and session chair for Batteries, Fuel cells and materials for Environmental protection in International Conference of Young Researchers on Advanced Materials (ICYRAM-IUMRS) 2012, Singapore. Serving as member in International center for diffraction data (ICDD), USA. He trained many local high school/college and International exchange students. His projects won many awards in national and international conferences and his project won 2nd prize in prestigious Intel International Science & Engg. Fair (ISEF 2013) and 1st prize from American Chemical Society, USA. He won outstanding Science Mentorship Award (2010, 2011, 2012, 2013 and 2015), from Ministry of Education, Singapore and Inspiring Research Mentor Award (2011, 2012, 2013, 2014 & 2015) from NUSHS. For other details <http://scholar.google.com.sg/citations?user=pWKR2M0AAAAJ&hl=en>.