Title: Low cost sodium ion batteries for large scale grid storage applications

Overview:

Sodium ion batteries (SIBs) are considered as potential alternative to Lithium ion batteries (LIBs) for large scale energy storage applications, such as grid storage and EV applications due to their on par specific energy and low-cost. However, plenty of research efforts are required to find suitable electrode materials and electrolyte to achieve on par specific energy to that of LIBs. In this respect, different electrode materials are selected based on their promising electrochemical properties, such as transition metal layered oxides with high specific capacity and polyanionic compounds with long cycle life as cathodes; whereas hard carbon and sodium titanates with low sodium insertion potential and high specific capacity as anodes and electrolyte with high ionic conductivity and wide electrochemical stability window for sodium ion batteries. By novel synthesis approach, cathode and anode materials with high specific capacity and long cycle life has been demonstrated using in-house developed electrolyte with high ionic conductivity.

Key Features

- High specific energy and power density, good rate capability, excellent cycle life, high thermal stability and safe-in operation.
- Low- cost and wider operating temperature range.

Potential Applications

- Large scale electric energy storage (EES)
- Stationary energy storage
- Electric/hybrid electric vehicles

Intellectual Property Development Indices (IDPI)

- Electrolytes with very high ionic conductivity and electrochemical stability window has been prepared and tested.
- Electrode materials with excellent sodium storage performance has been developed, where cycle life >1000 cycles has been demonstrated in full cell configuration.
- Scale-up synthesis is being optimized.

Major Patents/Publications

Patent

- "Method for preparing electrode materials of alkali ion transition metal phosphates and the product there of" Bijoy Kumar Das, P. Laxman Mani Kanta, Lakshmi Priya N., R. Gopalan, G. Sunderarajan, Application Number: 201911008004, filed February 28, 2019.

Book Chapter

- Bijoy Kumar Das, R. Gopalan (2019) 'Intercalation-based Layered Materials for Rechargeable Sodium-ion Batteries', *Layered Materials for Energy Storage and Conversion*. RSC Publisher.

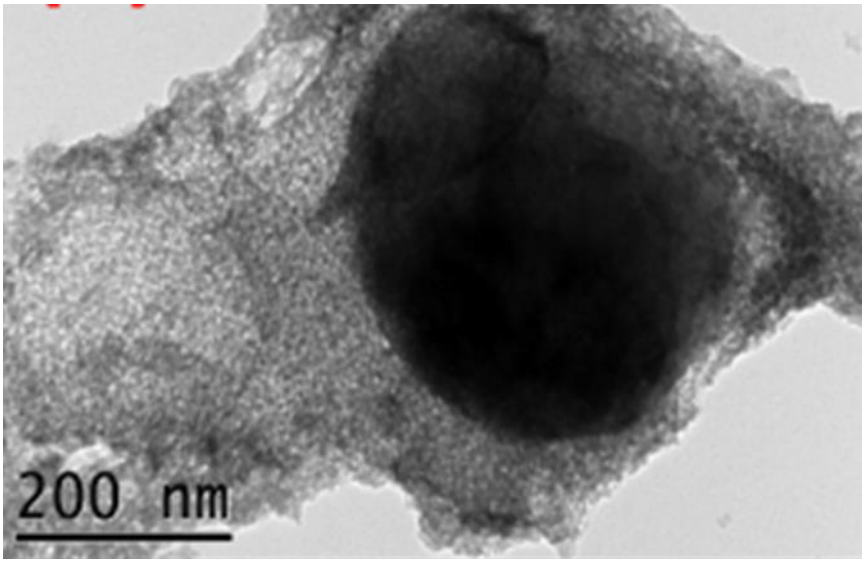

Figure Caption: Tem image of *in-situ* carbon coated $Na_3V_2(PO_4)_3$ nanoparticles embedded in mesoporous carbon matrix.