IITB-Monash Research Academy

Indian Institute of Technology Bombay | MONASH University

An Indian-Australian research partnership

Project Title:	**Electrolyte development based on ionic liquids for eco-friendly sodium-ion battery**	
Project Number	**IMURA0391**	
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Research Academy Themes:

Highlight which of the Academy's Theme(s) this project will address?
(*Feel free to nominate more than one. For more information, see www.iitbmonash.org)*

1. Advanced computational engineering, simulation and manufacture
2. Infrastructure Engineering
3. **Clean Energy**
4. Water
5. **Nanotechnology**
6. Biotechnology and Stem Cell Research

The research problem

Lithium-ion batteries have been optimized currently for high energy density applications and widely used in consumer electronics. However, for large scale secondary battery storage priority goes to cost performance, so they can be minimize the environmental impact and materials cost rather than energy density.

In this contest, sodium ion battery is considered as an emerging battery technology after lithium-ion and many researchers are attracted towards the development of Na-ion electrochemistry and new electrode materials. However, great difficulty arises here because of lack of suitable high rate anode (intercalated electrode) and electrolyte for

sodium battery development.

Currently, the common electrolyte is used either $NaPF_6$ or $NaClO_4$ as salt dissolve in polycarbonate solvent like known lithium battery. However, the electrochemistry of sodium and lithium is completely different since ionic sizes are different and solvation number and transport characteristics are also different. So, use of same composition like lithium ion battery electrolyte will not be a wise idea and could cause great difficulty in future battery development. In recently literatures observe, the use of polycarbonate electrolyte in conjunction with sodium anode, corrodes the anode rather forming SEI layer as in case of Lithium-ion battery. The above phenomena effects quite largely and results in large capacity fading and poor cycle stability.

In particular, ionic liquids (ILs) have many properties of interest for safer and in some cases environmental friendly character such as non volatility and non flammability. Since, studies of ILs with sodium salt to create sodium ion battery electrolyte is in very early stage, here we propose a research proposal which includes 1) development of IL as sodium-ion battery electrolyte

Project aims

1) Development of IL as sodium-ion battery electrolyte
2) Optimize the composition
3) Study their detailed electrochemistry in terms of battery performance and understand the different Na-ion electrochemistry.

Expected outcomes

1) *New electrolyte development for sodium-ion battery based on ILs*
2) *Unfold sodium-ionbatteryelectrochemistry*

How will the project address the Goals of the above Themes?

Describe how the project will address the goals of one or more of the 6 Themes listed above.

Capabilities and Degrees Required

- *Chemistry as major with sound knowledge in inorganic material synthesis, electrochemistry and solid-state chemistry*

Potential Collaborators

Please visit the IITB website www.iitb.ac.in OR Monash Website www.monash.edu to highlight some potential collaborators that would be best suited for the area of research you are intending to float.