

An Indian-Australian research partnership

Project Title:	2D iron for energy storage	
Project Number	IMURA0808	
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Research Clusters:

Research Themes:

Highlight which of the Academy's CLUSTERS this project will address? <i>(Please nominate JUST <u>one</u>. For more information, see www.iitbmonash.org)</i>		Highlight which of the Academy's Theme(s) this project will address? <i>(Feel free to nominate more than one. For more information, see www.iitbmonash.org)</i>	
1	Material Science/Engineering (including Nano, Metallurgy)	1	Advanced computational engineering, simulation and manufacture
2	Energy, Green Chem, Chemistry, Catalysis, Reaction Eng	2	Infrastructure Engineering
3	Math, CFD, Modelling, Manufacturing	3	Clean Energy
4	CSE, IT, Optimisation, Data, Sensors, Systems, Signal Processing, Control	4	Water
5	Earth Sciences and Civil Engineering (Geo, Water, Climate)	5	Nanotechnology
6	Bio, Stem Cells, Bio Chem, Pharma, Food	6	Biotechnology and Stem Cell Research
7	Semi-Conductors, Optics, Photonics, Networks, Telecomm, Power Eng	7	Humanities and social sciences
8	HSS, Design, Management		

The research problem

Energy storage and generation is the current problem at hand due to large demand for energy usage. With depletion of fossil fuel, the current situation is expected to get aggravated thereby requiring immediate attention. Several strategies are being explored in this pursuit and development of novel morphologies and materials systems is one direction of pursuit and is expected to provide significant breakthrough in energy storage.

Iron being earth abundant and hence economical, is expected to lower material costs in development of these devices. The student will be required to perform extensive literature review and understand the concepts related to such materials and charge storage mechanisms in energy storage devices. The student is expected to work towards synthesis of iron nanostructures and develop novel concept to incorporate them in energy storage solutions. This will be followed by materials characterization such as optical spectroscopy, structural analysis using X-rays along with microscopy (SEM, TEM, AFM). Further these will also be characterized electrochemically and several techniques such as impedance spectroscopy, CV, charge-discharge techniques etc will be used. The project will also involve a computational part in which the student will be required to do Ab-initio simulations to develop an understanding at atomistic scales.

Project aims

Synthesis of novel Iron/Iron oxide morphologies
Materials characterizations
Electrochemical characterization
Development of strategies for energy storage devices

Expected outcomes

Understanding based on simulations on use of iron in energy storage
New hybrid devices, Novel morphologies and compositions

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.

The project is aimed towards energy storage solutions and will be using nanomaterials for the same.

Capabilities and Degrees Required

Bachelors/Masters in Physics/ Chemistry/Materials Science/ Electrical engineering/Chemical Engineering/Polymers and any relevant branch of engineering

Potential Collaborators

Select up to (4) keywords from the Academy's approved keyword list (available at www.iitbmonash.org) relating to this project to make it easier for the students to apply.

Energy storage, Iron nanostructures, synthesis, characterization, electrochemistry, Simulations