

An Indian-Australian research partnership

**Project Title:** Investigation of Thermal Properties of Nanofluids

**Project Number** IMURA0286

Monash Supervisor(s) Prof Wenlong Cheng *Full names and titles*

Monash Primary Contact: [wenlong.cheng@monash.edu](mailto:wenlong.cheng@monash.edu) +61399053147 *Email, phone*

Monash Head of Department: Prof Paul Webley *Full name, email*

Monash Department: Department of Chemical Engineering *Full name*

Monash ADRT: Prof. Chris Davies *Full name, email*

IITB Supervisor(s) Prof. Anuradda Ganesh, Prof. P C Ghosh *Full names and titles*

IITB Primary Contact: [aganesh@iitb.ac.in](mailto:aganesh@iitb.ac.in) +91 22 25767886 *Email, phone*

IITB Head of Department: Prof Anuradda Ganesh *Name, Email,*

IITB Department: Department of Energy Science and Engineering *Full name*

## 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](http://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

The aim of the project is to investigate the thermal properties and application of nanofluids. The work would involve synthesis and characterisation of nanomaterial dispersions, for which the materials would be amongst metals, metal oxides, carbon nanotubes and their composites like metal / metal oxide encapsulated in carbon nanostructures, core shell structures. The synthesis would involve green chemical routes.

## Project aims

To investigate the effect of nanoparticle material, morphology, surface chemistry on the thermal properties of nanofluids.

## Expected outcomes

- Devising of various procedures to synthesize nanofluids
- Fundamental understanding of methods for the dispersion of nanoparticles in liquids, and the role of surfactants on this process.
- Results showing the variation in thermal conductivity of fluids as a function of, size, shape, composition, surface chemistry and loading fraction of nanoparticles.
- Investigation of experimental techniques for the measurements of variations in bulk thermal conductivity and specific heat capacity of liquids.
- Long term stability of nanofluids for thermal applications

## 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.*

Nanofluids are a new class of materials or engineered fluids which are nanoparticles dispersed and stabilised in liquid phase. The main application of the nanofluids is as heat transfer fluids. They exhibit Enhanced thermal conductivity, specific heat capacity and enhancement in single phase heat transfer coefficient. They aid in enhanced cooling, waste heat recovery and solar heat absorption and transport. The research would involve synthesis and long term stabilisation of nanofluids, and investigating their thermal and rheological properties by varying the particle size, particle shape/morphology, surface charge and interfacial chemistry, chemical environment like the pH and base fluids. The project aims at using green chemical methods like room temperature synthesis, water as solvent for chemical synthesis as well as base fluid, use of biological feedstock as a source of carbon and biological/biochemical synthesis of nanomaterials. The said materials aid in energy efficiency, use of renewable (clean) sources of energy hence falls under 'Clean Energy' category. The research aims to extensively harness the unique properties of nanomaterials owing to the size and shape. Hence the project falls into the category of 'Nanotechnology' and 'Clean energy'.

## Capabilities and Degrees Required

Essential: : Masters in Chemistry

Desirable: Chemistry of Colloids, Experience in Nanomaterials synthesis

Desirable : Experience in Instrumental methods of Characterization (Spectroscopy and Microscopy)

Desirable: Organic synthesis, surface chemistry.