

An Indian-Australian research partnership

Project Title:	Patterning of photoresponsive smart materials	
Project Number	IMURA0667(1)	
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IITB Department:	MEMS	

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
7. Humanities and Social Sciences

The research problem

Smart materials respond to external stimuli such as heat, light, stress etc. Of these possible stimuli, light is particularly appealing as it is a low-energy, clean and abundant resource for effecting changes within nanomaterial systems. Printing, stamping or controlled deposition of such responsive materials takes us into a further new dimension of patterned smart materials. Such surfaces can respond to external signals such as photons collectively in unison, giving rise to resonant phenomena. These patterned smart

materials find applications in sensors for biomedical devices, optoelectronic devices, foldable unmanned aerial vehicles, to name a few. In this project, the creation of patterned arrays of photo-responsive materials will be performed, utilising photosensitive stabilisers and a range of organic and inorganic particles. Extensive studies on the patterning process, photochemistry and surface chemistry will be performed to evaluate the change in the properties of these photo-responsive materials after patterning. Structural and optical characterization will be used to substantiate these findings and to determine the changes in surface properties on photo-switching of the light sensitive materials. Once these characterisations have been completed, the materials will be tested in proof of concept devices as sensors and optoelectronic arrays.

Project aims

- > Design/modify and prepare photoresponsive materials for patterning;
- > Develop photo-sensitive particle dispersions using photo-responsive stabilisers;
- > Develop/optimize patterning process for smart materials;
- > Characterize patterned smart materials in terms of their surface properties, optical properties and photo-response;
- > Optimize fabrication/preparation process iteratively;
- > Test surfaces in simple sensor and array devices.

Expected outcomes

- > Photo-responsive particle dispersions that can be controlled using light;
- > Process development for patterning smart material & characterization;
- > Photo-sensitive surfaces suitable for use in smart sensors and optoelectronic devices.

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

Smart materials are next generation materials that have great potential in driving the next wave of consumer electronics, medical devices and testing platforms. Existing smart materials are in bulk state, and thus are not suitable for a wide range of applications where surface interactions become important. We are attempting to pattern some of these smart materials specifically on surfaces, to provide materials that can be used in sensing, optoelectronics, energy and other applications.

Capabilities and Degrees Required

BTech, MTech, MSc in EE, Physics, Material Science, Green Energy, Laser, Optics, ME, CE, ESE or any other relevant field.

Experience in surface patterning/preparation, optics or dispersion science would be preferred.

Potential Collaborators

Rico Tabor

Please provide a few key words relating to this project to make it easier for the students to apply.

Patterning, smart materials, optical characterization