IITB-Monash Research Academy

Indian Institute of Technology Bombay | MONASH University

An Indian-Australian research partnership

Project Title:	2D and 3D patterned surfaces for tip-enhanced raman spectroscopy	
Project Number	**IMURA0811**	
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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

Tip- enhanced Raman spectroscopy (TERS) is an upcoming tool for high sensitivity detection of Raman active molecules at the nanoscale. Various patterned structures and Surface Enhanced Raman spectroscopy (SERS) active substrates have been used in the past for improving the sensitivity of the Raman technique. Here, we plan to synergise the expertise of IIT Bombay in patterning and Raman spectroscopy expertise at Monash University for this project. Two-photon lithography on various polymeric and composite structures will be performed for patterning substrate. Basic Raman spectroscopy experiments on these substrates will be performed at IIT Bombay. TERS along with SERS

will be performed at Monash University. Simulations will also be performed to find the best architecture for enhancements. Finally all the patterned structures will be characterized and optimized using TERS.

Project aims

Patterning of substrate
Strategic patterning for enhancing the Raman effect
Simulations
SERS on patterned substrate
TERS on SERS active substrate

Expected outcomes

Patterned TERS and SERS substrate with optimized parameters
Process development for SERS substrate

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

Lithography at sub diffraction level will allow patterns to be made much below 1micrometer linewidths. This in turn would affect the performance of Raman signal sensitivity. Here using ingeneously developed technology of two-photon lithography, we will achieve nanostructured surfaces, to be used for SERS and TERS 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, FDTD simulations, optics or SERS would be preferred.

Potential Collaborators

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

Patterning, SERS, TERS, optical characterization