INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Programme of Study : **Ph.D.**

Thesis Title: **Deriving Functional Interfaces from Chemically Reactive and Porous Dip Coating**

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Thesis Submitted to the Department/ Center : **CHEMISTRY**

Date of completion of Thesis Viva-Voce Exam : **18.08.2023**

Key words for description of Thesis Work : **ANTI-WETTING, WETTABILITY PATTERNED SURFACES, ANTICOUNTERFEITING, SENSING**

SHORT ABSTRACT

Bioinspired liquid wettability and patterned interfaces remained an inspiration for developing various functional materials/interfaces for relevant and important applications. The essential criteria for contriving bio-inspired extremes of water wettability (either superhydrophobicity or superhydrophilicity) is the co-optimization of hierarchical topography and essential surface chemistry. In general, such optimization is artificially achieved following various top-down and bottom-up approaches, where various hydrophilic building blocks are associated using electrostatic interaction, hydrogen bonding, and other weak bonding (e.g., metal-thiol etc.), for developing the desired hierarchical features and optimizing the appropriate chemistry on top of this featured interface. However, such common and conventional designs are inappropriate for sustaining practically relentlessly harsh settings. So, further development for the synthesis of a durable and substrate-independent superhydrophobic coating is essential for various prospective applications in "real-world" scenarios. In this thesis, I have successfully accounted a simple and single-step dip coating process to achieve a substrate- independent, chemically reactive, and porous polymeric coating following a 1,4-conjugate addition reaction at ambient conditions. Such chemically reactive polymeric dip coatings were further exploited for demonstrating pertinent applications, i.e., oil-water separation, self-cleaning, strain sensing, and anti-counterfeiting. The thesis entitled as "Deriving Functional Interfaces from Chemically Reactive and Porous Dip-Coating" has been codified in six chapters. **Chapter 1** accounts for the introduction of bio-inspired liquid wettability and the discussion on the existing challenges related to durability, scalability and substrate independency. The potential utilization of prospective porous and chemically reactive coatings was also presented in this chapter. In

Chapter 2, a simplistic approach of single step dip-coating technique is introduced to synthesize a substrate-independent and highly abrasion tolerant superhydrophobic coating. Further, the superhydrophobic coating on water soluble (sugar cube) substrate allowed the designing of a highly compressible and durable superhydrophobic sponge for the separation of crude oil-water mixture with an efficiency of > 99%. In **Chapter 3**, I have developed an abrasion tolerant superhydrophobic and conductive patterned interface for real-time and wireless monitoring of slow, fast, weak and strong human motions and expressions as well. The dip-coated porous polymeric interfaces were extended in **Chapter 4,** to develop a spatially selective chemically modulated patterned interface, where the strategic association of chemically modulated patterned wettability allowed to achieve a transient, and reversible visualization of hidden information with the naked eye. In **Chapter 5,** I have exploited the dual residual chemical reactivities of the prepared polymeric dip coating for developing an orthogonally readable, abrasion tolerant and miniaturized bulk-patterns through 1,4-conjugate addition reaction. Finally, in **Chapter 6**, summary of my entire thesis work has been elaborated and future prospects of the current design of chemically reactive dip coating are also provided.