Tunable Superomniphobic Surfaces for Sorting Droplets by Surface Tension

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Recent years have seen significant advances in the understanding of super-repellent surfaces, i.e., surfaces with extreme repellency to liquids. Surfaces with extreme repellency to water are considered to be superhydrophobic. Surfaces with extreme repellency to oils are considered to be superoleophobic. Surfaces that are both superhydrophobic and superoleophobic are considered to be superomniphobic surfaces. In other words, superomniphobic surfaces are extremely repellent to virtually all liquids – organic and inorganic acids, bases or solvents; Newtonian or non-Newtonian liquids; polar or non-polar liquids. Advances in the design and fabrication of superomniphobic surfaces are paving the way to military and civilian applications.

In this presentation, the fundamental chemical and physical principles of designing super-repellent surfaces will be reviewed. Based on these principles, the fabrication of superomniphobic with tunable wetting will be demonstrated. Utilizing these tunable superomniphobic surfaces, the systematic design of a simple device that can sort droplets based on their surface tension will be discussed. Further, the application of such devices in enabling inexpensive and energy-efficient personalized point-of-care diagnostic platforms will be discussed.