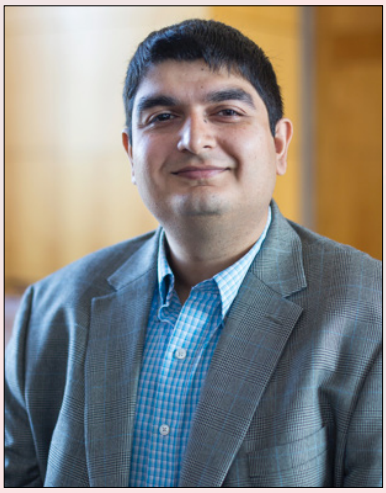
Nebraska Center for Materials and Nanoscience

2017 Fall Seminar Series

Co-sponsored with Dept. of Chemical & Biomolecular Engineering

Anish Tuteja



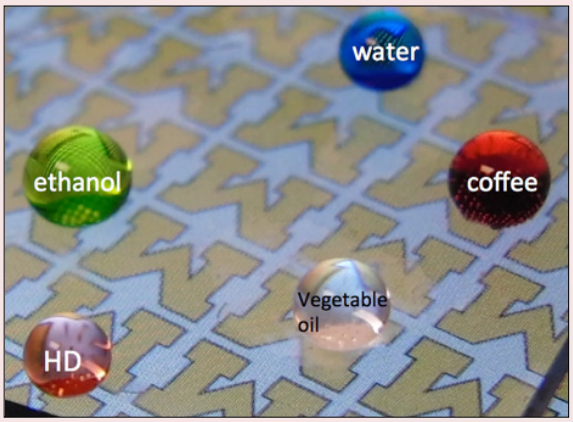
Designing Surfaces with Extreme Wettabilities

Dept. of Materials Science and Engineering, Dept. of Chemical Engineering,
Macromolecular Science and Engineering, BioInterfaces Institute,
Associate Professor, University of Michigan

In this talk, Dr. Tuteja will discuss his group's current work on developing surfaces with extreme wettabilities, i.e. surfaces that are either completely wet by, or completely repel, different liquids. The first portion of the talk will cover the design of so-called "*superomniphobic surfaces*" or surfaces which repel all liquids. Designing and producing textured surfaces that can resist wetting by low surface tension liquids, such as various oils or alcohols, has been a significant challenge in materials science and no examples of such surfaces exist in nature. As part of this work, Dr. Tuteja will explain how re-entrant surface curvature, in addition to surface chemistry and roughness, can be used to design surfaces that cause virtually all liquids (including oils; alcohols; water; concentrated organic and inorganic acids, bases, solvents), as well as viscoelastic polymer solutions, to roll-off and bounce.

The second portion of his talk will cover the design of the first-ever reconfigurable membranes that, counter-intuitively, are both *superhydrophilic* (water contact angles $\cong$ 0°) and *superoleophobic* (oil contact angles > 150°). This makes these porous surfaces ideal for gravity-based separation of oil and water as they allow the higher density liquid (water) to flow through while retaining the lower density liquid (oil). These fouling-resistant membranes can separate, for the first time, a range of different oil-water mixtures, including emulsions, in a single-unit operation with >99.9% separation efficiency by using the difference in capillary forces acting on the oil and water phases. As the separation methodology is solely gravity-driven, it is expected to be one of the most energy-efficient technologies for oil-water separation.

Dr. Tuteja will also discuss surfaces with patterned wettability, where both wetting (omniphilic) and non-wetting (omniphobic) domains are fabricated on the same substrate. Such substrates are used for fabricating monodisperse, multi-phasic, micro- and nano-particles possessing virtually any desired composition, projected shape, modulus, and dimensions as small as 25 nm. Finally, he will discuss some other areas of current and future research, including the development of *ice-phobic* coatings that offer one of the lowest reported adhesion strengths with ice.



A transparent superomniphobic coating applied on top of an iPhone screen.

November 21 | 4 p.m. | 136 Jorgensen Hall

Refreshments provided

Host: Srivatsan Kidambi

Department of Chemical and Biomolecular Engineering