PL-01-2-PL-M

Everything slips: design of novel omniphobic materials

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Liquids entrapped within a structured solid begin to exhibit unique behaviors often providing the surrounding material with unprecedented properties. Recently we have introduced a new, award-winning strategy (2012 R&D 100 award) to create self-healing, anti-fouling materials (so-called Slippery, Lubricant-Infused Porous Surfaces, or SLIPS). These bioinspired materials that mimic slippery surfaces of a pitcher plant outperform state-of-the-art materials in their ability to resist ice and microbial adhesion, repel various simple and complex liquids, prevent marine fouling, or reduce drag. Generalized, low-cost, and scalable methods to manufacture stable, shear-tolerant SLIPS on glass, ceramics, polymers, fabrics and metals will be presented. We anticipate that slippery surfaces can find important applications as antifouling materials in medicine, construction, naval and aircraft industries, fluid handling and transportation, optical sensing, and as antifouling surfaces against highly contaminating media operating in extreme environments.

Select publications: T.-S. Wong et al. Nature 477 (2011); A.K Epstein et al. Proc. Nat. Acad. Sci. USA 109 (2012); P. Kim et al. ACS Nano 6 (2012); X. Yao et al. Nature Mater. 12 (2013); P. Kim et al. Nano Lett. 13 (2013); D. Daniel et al. Appl. Phys. Lett. 102 (2013); N. Vogel et al. Nature Comm. 4 (2013); C. Shillingford et al. Nanotechnology 25 (2014); S. Sunny et al. Adv. Funct. Mater. 24 (2014); D.C. Leslie et al. Nature Biotech. 32 (2014); J. Cui et al. Nature Mater. 14 (2015); X. Hou et al. Nature 519 (2015)