



Staying dry under water

Jones, Paul; Cruzchu, Eduardo; Megaridis, Constantine; Walther, Jens Honore; Koumoutsakos, Petros; Patankar, Neelesh

Published in:
American Physical Society. Bulletin

Publication date:
2012

Document Version
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

Citation (APA):
Jones, P., Cruzchu, E., Megaridis, C., Walther, J. H., Koumoutsakos, P., & Patankar, N. (2012). Staying dry under water. *American Physical Society. Bulletin*, 57(17), Paper DFD12-2012-001193.

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Staying dry under water¹ PAUL JONES, Department of Mechanical Engineering, Northwestern University, EDUARDO CRUZ-CHU, Institute of Computational Science, ETH Zurich, CONSTANTINE MEGARIDIS, Department of Mechanical and Industrial Engineering, University of Illinois, JENS WALTHER, Institute of Computational Science, ETH Zurich and Department of Mechanical Engineering, Tech. University of Denmark, PETROS KOUMOUTSAKOS, Institute of Computational Science, ETH Zurich, NEELESH PATANKAR, Department of Mechanical Engineering, Northwestern University — Lotus leaves are known for their non-wetting properties due to the presence of surface texture. The superhydrophobic behavior arises because of the prevention of liquid water from entering the pores of the roughness. Present superhydrophobic materials rely on air trapped within the surface pores to avoid liquid permeation. This is typically unsustainable for immersed bodies due to dissolution of the air, especially under elevated pressures. Here, molecular dynamics simulations are used to demonstrate the non-wetting behavior of an immersed ten-nanometer pore. This is accomplished by establishing thermodynamically sustained vapor pockets of the surrounding liquid medium. Over 300,000 atoms were used to construct the nanopore geometry and simulate SPC/E water molecules. Ambient pressure was varied along two isotherms (300 K, and 500 K). This approach for vapor-stabilization could offer valuable guidance for maintaining surfaces dry even in a submerged state without relying on trapped air. The approach may be extended to control general phase behavior of water adjacent to textured surfaces.

Prefer Oral Session
 Prefer Poster Session

¹ISEN support is gratefully acknowledged
Paul Jones
jones@u.northwestern.edu
Department of Mechanical Engineering, Northwestern University