coatings

Epidermal Gland Inspired Self-Repairing Slippery Lubricant-Infused Porous Coatings with Durable Low Ice Adhesion

Tong Li, Yizhi Zhuo, Verner Håkonsen, Sigrid Rønneberg, Jianying He * and Zhiliang Zhang *

NTNU Nanomechanical Lab, Department of Structural Engineering, Norwegian University of Science and Technology (NTNU), 7491 Trondheim, Norway; tong.li@ntnu.no (T.L.); yizhi.zhuo@ntnu.no (Y.Z.); verner.hakonsen@ntnu.no (V.H.); sigrid.ronneberg@ntnu.no (S.R.)

* Correspondence: jianying.he@ntnu.no (J.H.); zhiliang.zhang@ntnu.no (Z.Z.)

Supplementary Materials

Modulus of the Coatings by Nanoindentation Tests.

The reduced modulus of the sample is calculated as $E_r = S/D$, where D is the diameter of the cylindrical flat punch [1]. Young's modulus of the materials can also be estimated because it is related to the measured reduced modulus as $1/E_r = (1 - v^2)/E + (1 - v_{tip}^2)/E_{tip}$, where v and v_{tip} are Poisson's ratio of the material and diamond indenter, respectively, and E and E_{tip} are Young's modulus of the material and diamond indenter, respectively. Here, the v for all samples were assumed to be the same and equal to 0.5 and $v_{tip} = 0.07$ and $E_{tip} = 1140$ GPa [1–2]. As $E_{tip} \gg E$, the second term of the equation is negligible. Hence, Young's modulus of the samples is approximated to $E = E_r (1 - v^2) = 0.75Er$. The shear modulus can be calculated from the equation: $E = 2G (1 + v)$ [3].

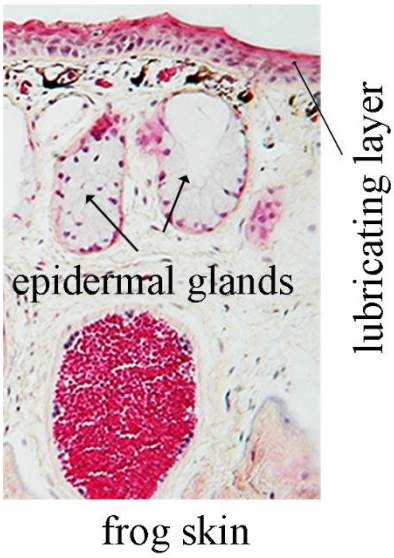

Figure S1. Cross-sectional image of frog skin [4].

Table S1. Properties of coatings prepared from varied weight ratio of hybrid surfactant.

Samples	Water Contact Angle at 0 s (°)	Water Contact Angle at 80 s (°)	Advancing Contact Angle (°)	Receding Contact Angle (°)	Contact Angle Hysteresis (°)
PDMS: 0%	111.5	111.3	127.5	68.1	59.4
10%	110.2	73.9	75.1	11.6	63.5
20%	106.0	72.8	76.3	12.6	63.7
30%	105.4	71	80.3	11.9	68.3
40%	105.9	45.6	68.5	6.0	62.5

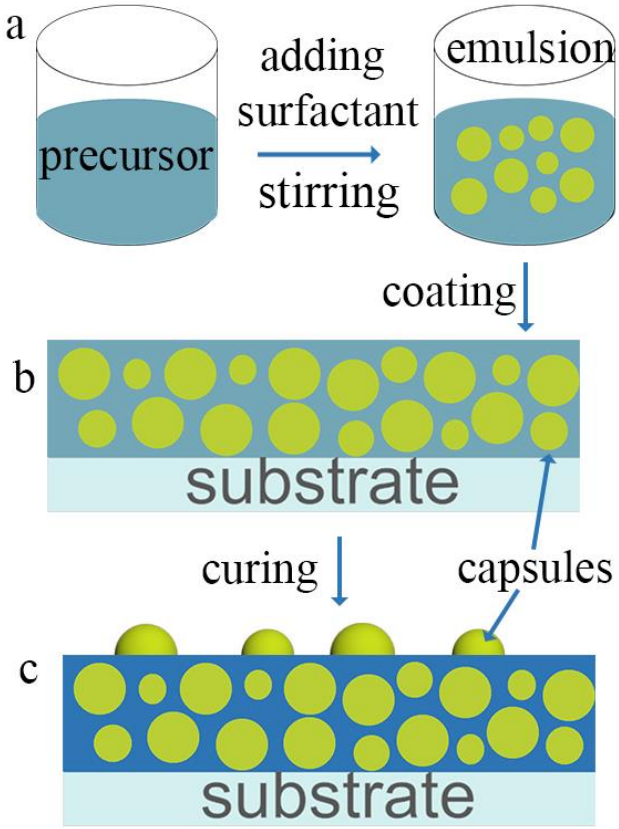

Figure S2. Schematic of fabricating the coatings.

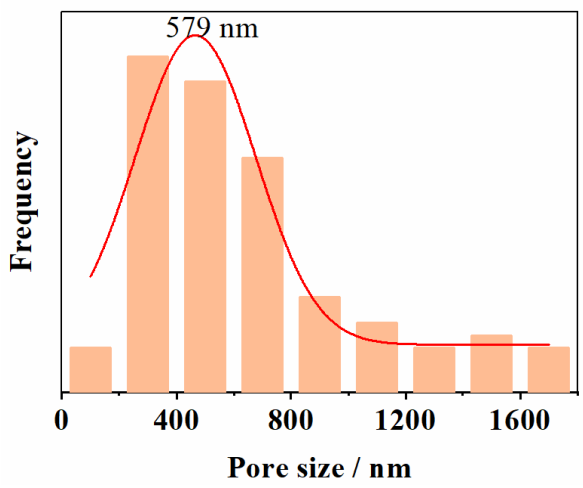

Figure S3. Pore size distribution of the 30% coating after removing the surfactant.

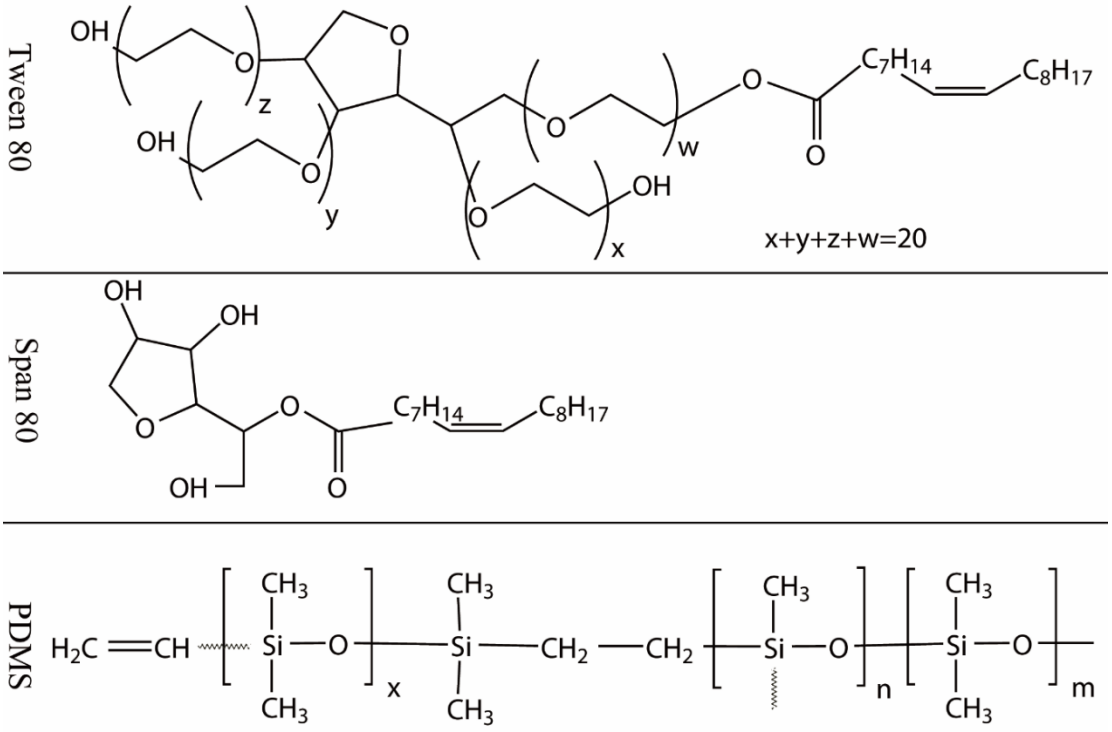

Figure S4. Chemical structural formula of Tween 80, Span 80 and PDMS.

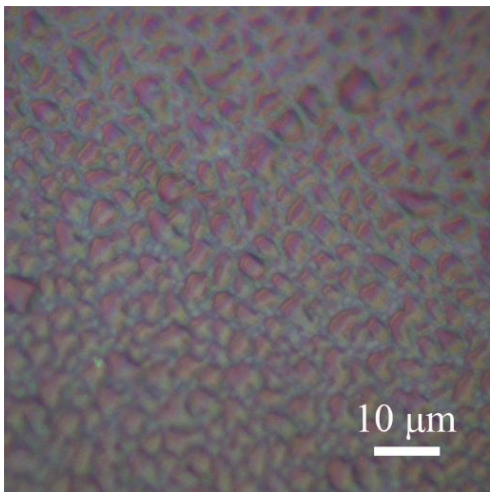

Figure S5. Optical micrograph of 30% coating before being wiped with lens paper.

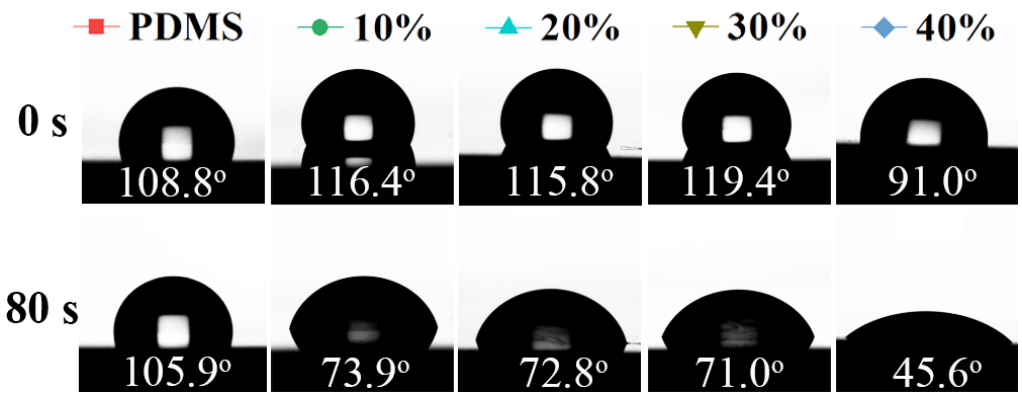

Figure S6. Digital images of the water contact angels of the samples at 0 and 80 s, respectively.

References

1. Wang, Z.; Volinsky, A.A.; Gallant, N.D., Nanoindentation study of polydimethylsiloxane elastic modulus using Berkovich and flat punch tips. *J. Appl. Polym. Sci.* **2015,** *132*, 41384.
2. Johnston, I.D.; McCluskey, D.K.; Tan, C.K.L.; Tracey, M.C., Mechanical characterization of bulk Sylgard 184 for microfluidics and microengineering. *J. Micromech. Microeng.* **2014,** *24*, 035017.
3. Huang, C.; Bian, Z.G.; Fang, C.F.; Zhou, X.L.; Song, J.Z., Experimental and Theoretical Study on Mechanical Properties of Porous PDMS. *J. Appl. Mech.* **2018,** *85*4, 041009.
4. Savalli, U.M., Vertebrate Anatomy: Frog Skin. Available online: http://www.savalli.us/BIO370/Anatomy/4.FrogSkinLabel.html (23, June, 2019).