Supplementary Information

Durability Studies of Underwater Superoleophobic Graphene Oxide Coated Wire Mesh

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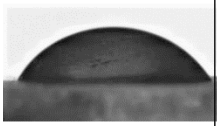
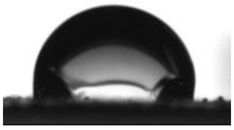
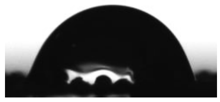
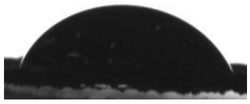
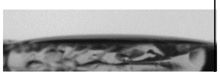
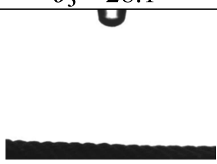
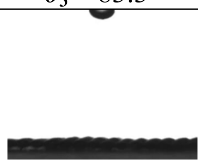
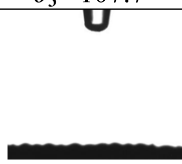
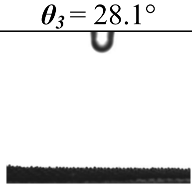
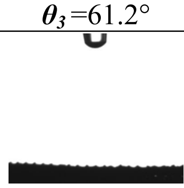
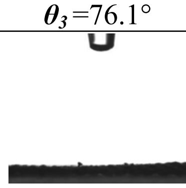
Typically, the liquid CA and wettability on a solid surface in the air are determined by using Young's equation. Young's equation can be modified for different settings, including the determination of CA of a liquid on a solid surface immersed in a second liquid. The modified equation can be written as:

$$\cos\theta_3 = \frac{\gamma_{o-a}\cos\theta_1 - \gamma_{w-a}\cos\theta_2}{\gamma_{o-w}} \qquad (1)$$

where γ_{o-a} is the oil-air interface tension, θ_1 is the CA of oil in the air, γ_{w-a} is the water-air interface tension, θ_2 is the CA of water in the air, γ_{o-w} is oil-water interface tension, and θ_3 is the CA of oil in water.

Table S1 lists the CA of different oils/non-polar liquids on GO-coated glass slide, bare mesh, GO-coated mesh, and GO*-coated mesh. Based on the γ_{w-a}, γ_{o-a}, and γ_{o-w} for Edible oil, toluene, and kerosene, we calculated the values of θ_3 using equation 1 (values mentioned in Table S1). As equation 1 based on Young's equation is for solid substrates, for GO-coated glass slide, we observed that equation 1 predicts the underwater CA for all oils/non-polar liquids, $\theta_3 > 100°$. This shows that GO-coated surfaces show oleophobic nature underwater. In case of bare mesh, GO-coated mesh and GO*-coated mesh, due to porosity, the liquid drops permeate through the mesh over different periods of time depending on wettability. As θ_2 varies due to porosity, the use of equation 1 will not give accurate values. We still have used the initial CA values to predict $\boldsymbol{\theta_3}$ values on meshes, as mentioned in Table 1, using equation 1. The calculated values of $\boldsymbol{\theta_3}$ show that with a decrease in the value of $\boldsymbol{\theta_2}$, the value of $\boldsymbol{\theta_3}$ increases. Thus, a more hydrophilic surface in the air will show better oleophobicity underwater.

Table S1: CA in air for different test liquids on GO coated surfaces/meshes.

Test Liquid	GO- Coated glass slide	Bare mesh	GO-coated mesh	GO*-coated mesh
Water γ_{w-a} = 72.8mN/m	 $\boldsymbol{\theta_2}$ = 59.8° ± 3°	 $\boldsymbol{\theta_2}$ = 92.7° ± 1.6°	 $\boldsymbol{\theta_2}$ = 81.3° ± 2.2° (initial CA)	 $\boldsymbol{\theta_2}$ = 74.3° ± 2° (initial CA)
Edible oil γ_{o-a} = 31.5 mN/m γ_{o-w} = 37.04 mN/m	 $\boldsymbol{\theta_1}$ = 31.9° ± 0.1° $\boldsymbol{\theta_3}$ = 105.5°	 $\boldsymbol{\theta_1}$ = 21.8° ± 0.2° (initial CA) $\boldsymbol{\theta_3}$ = 28.1°	 $\boldsymbol{\theta_1}$ = 60.9° ± 1.9° (initial CA) $\boldsymbol{\theta_3}$ = 83.3°	 $\boldsymbol{\theta_1}$ = 74.5° ± 0.5° (initial CA) $\boldsymbol{\theta_3}$ =107.7°
Toluene γ_{o-a} = 28.4 mN/m γ_{o-w} = 36.1 mN/m	 $\boldsymbol{\theta_1}$ = 10.5° ± 0.6° $\boldsymbol{\theta_3}$ =103.9°	 $\boldsymbol{\theta_1}$ = 0° (immediate spreading) $\boldsymbol{\theta_3}$ = 28.1°	 $\boldsymbol{\theta_1}$ = 0° (immediate spreading) $\boldsymbol{\theta_3}$ =61.2°	 $\boldsymbol{\theta_1}$ = 0° (immediate spreading) $\boldsymbol{\theta_3}$ =76.1°
Kerosene γ_{o-a} = 28.3 mN/m γ_{o-w} = 39.9 mN/m	 $\boldsymbol{\theta_1}$ = 13.5° ± 0.1° $\boldsymbol{\theta_3}$ =103.2°	 $\boldsymbol{\theta_1}$ = 0° (immediate spreading) $\boldsymbol{\theta_3}$ = 37.3°	 $\boldsymbol{\theta_1}$ = 0° (immediate spreading) $\boldsymbol{\theta_3}$ =64.3°	 $\boldsymbol{\theta_1}$ = 0° (immediate spreading) $\boldsymbol{\theta_3}$ =77.6°