# Supplementary Material 

# Empirical Formulae in Correlating Droplet Shape and Contact Angle 

Ten It Wong ${ }^{1}$, Hao Wang ${ }^{2}$, Fuke Wang ${ }^{1}$, Sau Leng Sin ${ }^{1}$, Cheng Gen Quan ${ }^{2}$, Shi Jie Wang ${ }^{1, *}$, Xiaodong Zhou ${ }^{1, *}$<br>${ }^{1}$ Institute of Materials Research and Engineering, A*STAR (Agency for Science, Technology and Research), 2 Fusionopolis Way, \#08-03, Innovis, Singapore 138634<br>${ }^{2}$ Department of Mechanical Engineering, National University of Singapore, 9 Engineering Drive 1, Singapore 117576<br>*Email: sj-wang@imre.a-star.edu.sg, donna-zhou@imre.a-star.edu.sg

## 1. The spherical dome model and its error

The simplest method to correlate the contact angle $(\theta)$, volume $(\mathrm{V})$, height $(\mathrm{H})$ and width ( W ) is to regard the droplet as a spherical dome and ignore the gravity induced droplet sagging, as presented in Figure S1. However, the deviation of the calculation will be high for a heavy (sessile) droplet or even a light (buoyant) droplet at a low surface tension surface.


Figure S1. The droplet sagging by gravity (solid profile), and the model assuming the droplet as a spherical dome (dashed profile). H and W are the height and width of the droplet.
2. The SEM images of some prepared samples


Figure S2. SEM images of (a) PMMA coated with silica nanospheres only and (b) PMMA coated with silica nanospheres and fluorosilane layer. The scale bar is $2 \mu \mathrm{~m}$.
3. The ratio of the measured parameter to the calculated one



Figure S3. The error of the calculation compared with measurements at different droplet volume and contact angle, for all 575 data sets taken in our experiments. The ratios of measured parameters to spherical dome calculated parameters are in red, the ratios of the measured parameters to our empirical formulas corrected parameters are in blue. The measured contact angle (for $\mathrm{a}, \mathrm{c}, \mathrm{e}, \mathrm{g}$ ) or the measured volume (for b,d,f,h) of these data sets were also plotted in black. (a) and (b) are for contact angle, (c) and
(d) are for volume, (e) and (f) are for height, and (g) and (h) are for width.

## 4. 3D coefficient functions for droplet volume, height, and width corrections

The ratios of the measured to the spherical dome model calculated parameters are calculated, with the group of 369 data for fitting only. These ratios (plotted as blue solid circles in Figure S4) were used to obtain the 3D coefficient functions expressed in Eqs (2), (4), (6), (7), (9) and (10). The 3D coefficient functions were plotted as 3D surfaces in Figure 2(a) for contact angle, Figure S4(a) for volume, and Figures S4(b)(e) for droplet height and width. The ratios for the non-fitting group are also plotted in these figures as hollow circles, and they mostly fall close to the fitting surface as well.



Figure S4. Fitted 3D surface for ratios of measured values to the calculated ones, and the data used for fitting (solid circles) and did not used for fitting (hollow circles). (a) is for volume calculated by height and width, (b) and (c) are for height calculated by volume and contact angle, and (d) and (e) are for width calculated by volume and contact angle. (c) and (e) are calculated by cosine of the contact angle.
5. Errors of the corrected calculations at fixed Young contact angle (YCA)

(b)


Figure S5. Errors of height (left) and width (right) for five kinds of materials (a) PMMA, (b) glass, (c) PMMA coated with nanoparticles (NP), (d) PMMA coated with fluorosilane (F), and (e) PMMA coated with nanoparticles and fluorosilane (NP \& F) for 6 cases. Cases 1 is error in spherical dome model at the exact measured contact angle (CA); Case 2 is largest error in empirical formula using fixed Young contact angle (YCA), YCA+SD, and YCA-SD; Case 3 is error in empirical formula with the exact measured CA; Case 4 is largest error in empirical formula using YCA,
$\mathrm{YCA}+\mathrm{SD}$, and YCA-SD; Case 5 is error in empirical formula with cosine of the exact measured contact angle; Case 6 is largest error in empirical formula using cosine of YCA, YCA+SD, and YCA-SD.

