Supporting Information

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SI Text

Substrate Characterization

We fabricated the substrates by the process shown in Fig. S1. We ensured the surface of the soft, gel substrates were flat via confocal microscopy. For several test substrates, we embedded small, 100-nm–radius, fluorescent particles on the open surface of the gel substrates, and at the gel–substrate interface (1). The substrates were floated upside down on a thin, water film on a glass slide, and the tracer particles imaged with a confocal microscope. The positions of the tracer particles collapse into substrate profile curves when viewed along the lenticules, as shown in Fig. S2 *A* and *B*. This shows that the substrate is approximately 1 μm thick at its shallowest point. To check surface flatness, we fitted a curve of the form $z = a + b\cos(2\pi(x-\phi)/\lambda)$ to the surface data. This is shown as the white, dashed line in Fig. S2*B*. The amplitude of the surface wave, b, is 12 nm, suggesting that there is negligible topography of the top surface of the substrates. We also see that the lenticules are highly regular, circular cylindrical sections, with a periodicity of λ = 170 μm. The radius of curvature of the lenticule surfaces is 91 μm.

Theoretical Prediction of Contact Angle Changes

The observed drop in contact angle for small droplets is captured by extending a simple, linear-elastic model (2). Using this model, which assumes that the solid surface stresses are equal on either side of the contact line, $\Upsilon_{SV} = \Upsilon_{SL} = \Upsilon_S$, we recently obtained quantitative agreement with observed surface profiles of silicone gel substrates of varying thickness under glycerol droplets of varying radii (2, 3). In particular, the theory captures the large qualitative shift in deformation profile with reducing droplet size—from a ridge localized at the contact line to a dimple. It also shows how substrate deformations reduce as the substrate thickness reduces, meaning that thinner substrates are effectively stiffer than thick substrates.

The angles between the three interfaces at the contact line are fixed in Neumann triangle-like configuration (4, 5). Thus, as the wedge formed locally by the solid–liquid and solid–vapor interfaces at the contact line rotates, the liquid–vapor interface rotates by the same amount. Our model predicts the slope of the solid surfaces at the contact line, which can then be used to calculate changes in contact angle. Wedge rotation is extracted from the theoretical results by calculating the line bisecting the solid–liquid and solid–vapor interfaces, and measuring the difference in angle between this and the large-drop limit bisecting line. This rotation gives the change in macroscopic contact angle. With experimentally determined parameters from our previous work (4), we plot the resulting theoretical contact-angle changes against the data in Fig. S3. There is very reasonable agreement between the theory and data. Disparities are likely due to differences in surface preparation—for our previous work (4), the surfaces were silanated, and here they are not. Finally, absolute values of θ are calculated by comparison with the measured contact angle for large droplets, 95°.

1. Xu Y, et al. (2010) Imaging in-plane and normal stresses near an interface crack using traction force microscopy. *Proc Natl Acad Sci USA* 107(34):14964–14967.
2. Style RW, Dufresne ER (2012) Static wetting on deformable substrates, from liquids to soft solids. *Soft Matter* 8(27):7177–7184.
3. Jerison ER, Xu Y, Wilen LA, Dufresne ER (2011) Deformation of an elastic substrate by a three-phase contact line. *Phys Rev Lett* 106(18):186103.
4. Style RW, et al. (2013) Universal deformation of soft substrates near a contact line and the direct measurement of solid surface stresses. *Phys Rev Lett* 110(6):066103.
5. Olives J (2010) Surface thermodynamics, surface stress, equations at surfaces and triple lines for deformable bodies. *J Phys Condens Matter* 22(8):085005.

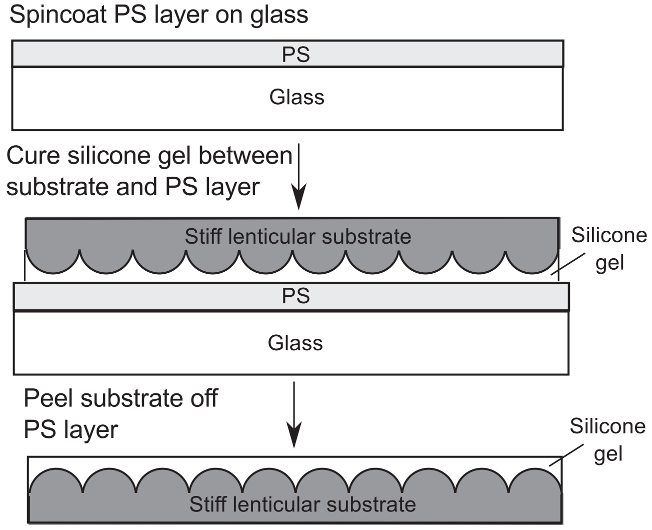


Fig. S1. Substrate fabrication technique. (*i*) A layer of polystyrene is spin coated onto a glass slide. (*ii*) Silicone gel is cured between the polystyrene-coated slide, and a lenticular substrate. This is compressed with a heavy, flat weight. (*iii*) After curing, the substrate is gently peeled off the polystyrene layer.

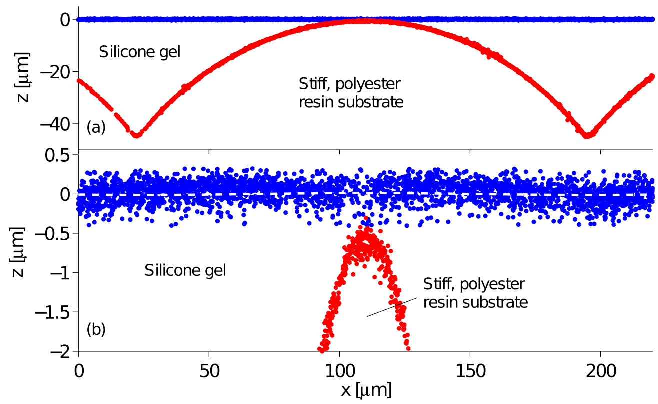


Fig. S2. Typical silicone gel surface profiles measured by confocal microscopy. Tracer particles are imaged and then collapsed along the direction parallel to the substrate lenticules. (*A*) 1–1 view of the surface profile. (*B*) Zoomed-in view of the surface region. The blue and red data correspond to top and bottom profiles of the substrate, respectively. The white, dashed line is a best-fit, sinusoidal curve for the surface profile.

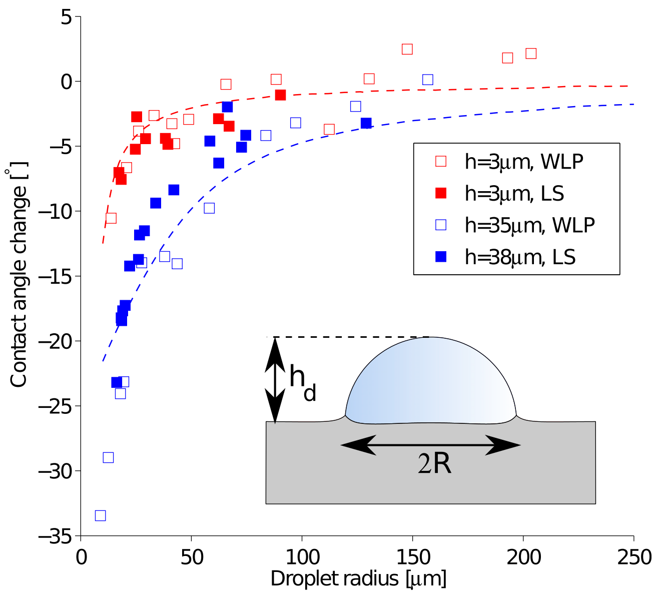
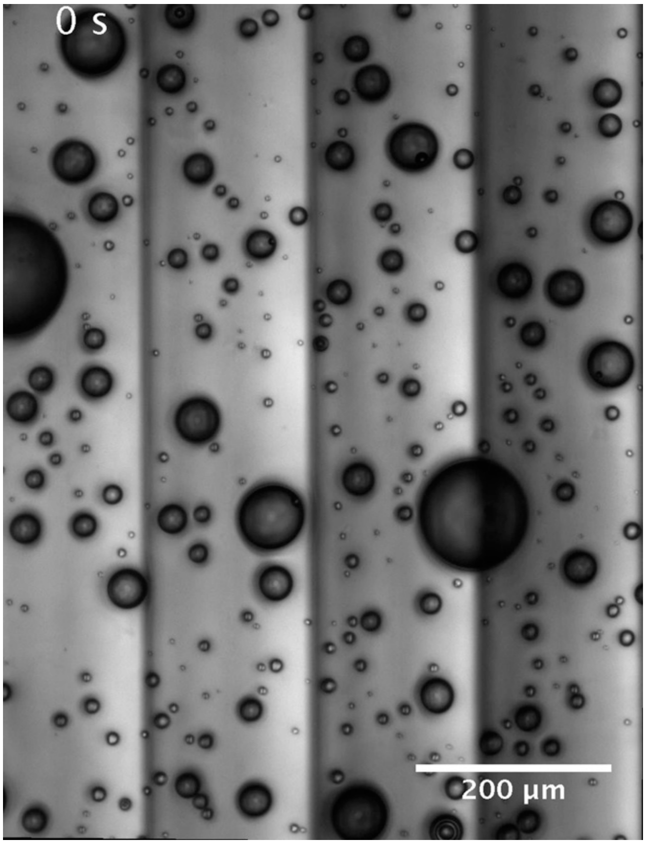
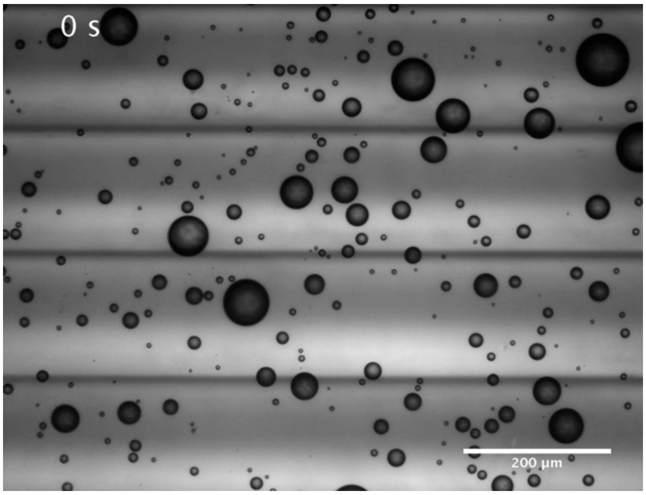


Fig. S3. Modeling change in contact angle with droplet size. Symbols show measured contact angle change ($\theta - 95°$) for glycerol droplets on a silicone gel as a function of droplet radius, R. Data are shown for thin silicone gel layers of $h = 3$ µm (red) and thicker layers $h = 35$, 38 µm (blue). The filled/open points were measured by laser scanning (LS)/white-light optical profilometry (WLP). The dashed curves show theoretical predictions for $h = 3$ µm (red) and $h = 35$ µm (blue). *Inset* shows the definitions of droplet height and footprint radius.



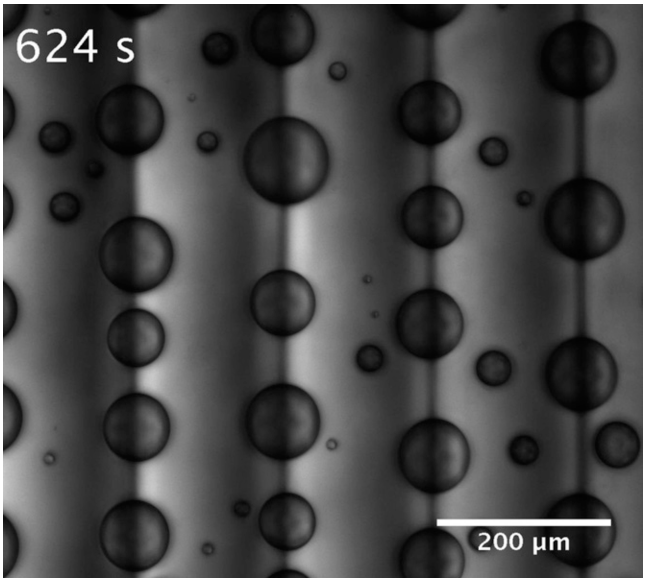
Movie S1. Glycerol droplets perform durotaxis on a soft, flat, silicone gel surface with Young's modulus of 3 kPa. Droplets move toward thicker parts of the substrate. The dark lines indicate the thickest part of the substrate.

Movie S1



Movie S2. Glycerol droplets do not perform durotaxis on a stiff, flat, silicone elastomer surface with Young's modulus of 1.8 MPa. The dark lines indicate the thickest part of the substrate.

Movie S2



Movie S3. Water droplets condensing onto and subsequently evaporating from a soft, flat, silicone gel surface with Young's modulus of 3 kPa. Condensation is initiated by cooling the substrate from below with a Peltier device. The cooling is removed after 560 s, causing the droplets to evaporate. Droplets line up on the thickest part of the substrate, indicated by the dark lines.

Movie S3