ADVANCED MATERIALS INTERFACES

Supporting Information

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Polymerization-Induced Wrinkled Surfaces with Controlled Topography as Slippery Surfaces for Colorado Potato Beetles

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Table T1: Film thickness t, wrinkle amplitude A, wavelength λ and the resulting aspect ratio AR for the three different acrylate films of Figure S4, for a monomer solution concentration of 20% v/v.

20% v/v	M10 [20% v/v]	M6 [20% v/v]	E3 [20% v/v]
***t* [nm]**	233 ± 47	145 ± 13	60 ± 36
***A* [µm]**	0.55 ± 0.13	0.44 ± 0.07	0.57 ± 0.07
***λ* [µm]**	10.97 ± 5.27	3.39 ± 1.47	2.33 ± 0.39
A*/*λ	0.05	0.13	0.24

Table T2: Film thickness t, wrinkle amplitude A, wavelength λ and the resulting aspect ratio AR for the three different acrylate films of Figure S4, for a monomer solution concentration of 40% v/v.

40% v/v	M10 [40% v/v]	M6 [40% v/v]	E3 [40% v/v]
***t* [nm]**	356 ± 36	231 ± 11	225 ± 36
***A* [µm]**	1.31 ± 0.29	0.69 ± 0.15	1.5 ± 0.17
***λ* [µm]**	12.67 ± 7.02	4.09 ± 1.15	5.08 ± 0.73
A*/*λ	0.10	0.17	0.29

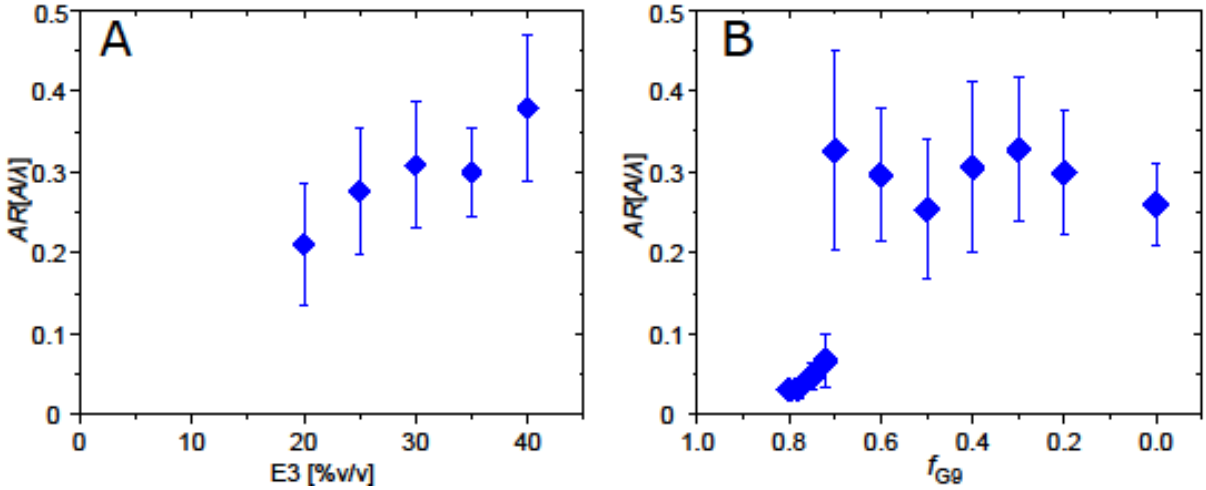

Figure S1: Wrinkle aspect ratios as a function of (A) E3 monomer solution concentration and (B) f_{G9} mixing ratio for an overall monomer solution concentration of 20% v/v.

FTIR investigations

Polymerised wrinkled E3 films cast from solution concentrations of 20% v/v – 40% v/v, were investigated by Fourier transformation infrared spectroscopy (FTIR). The polymerised films were compared to monomer film prior to plasma induced polymerisation.

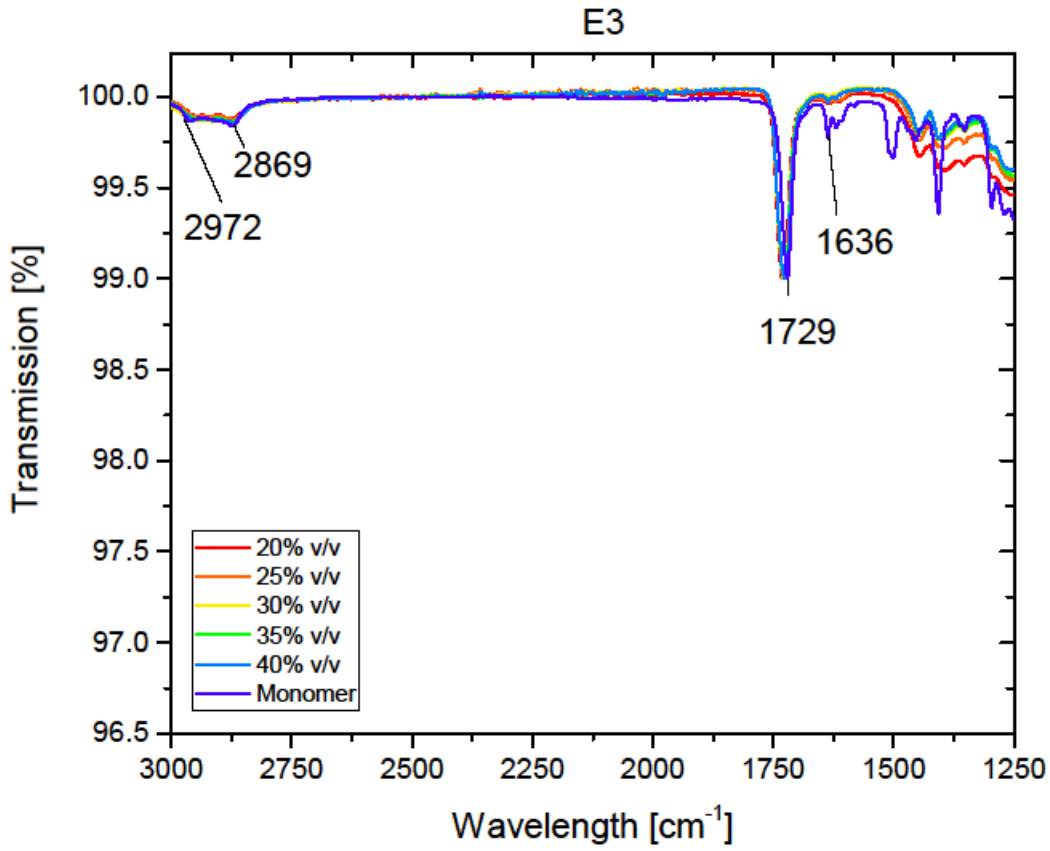

Figure S2: FTIR spectra of E3 monomer film prior to plasma polymerisation and plasma polymerised samples of films cast from various E3 solution concentrations.

The disappearance of the C=C peak at 1636 cm^{-1} was monitored to determine the monomer to polymer conversion. The C=O stretching band at 1729 cm^{-1} was chosen as an internal standard. After plasma treatment, all polymer films displayed a significant decrease of the peak at 1636 cm^{-1}, indicating near-complete polymerisation.

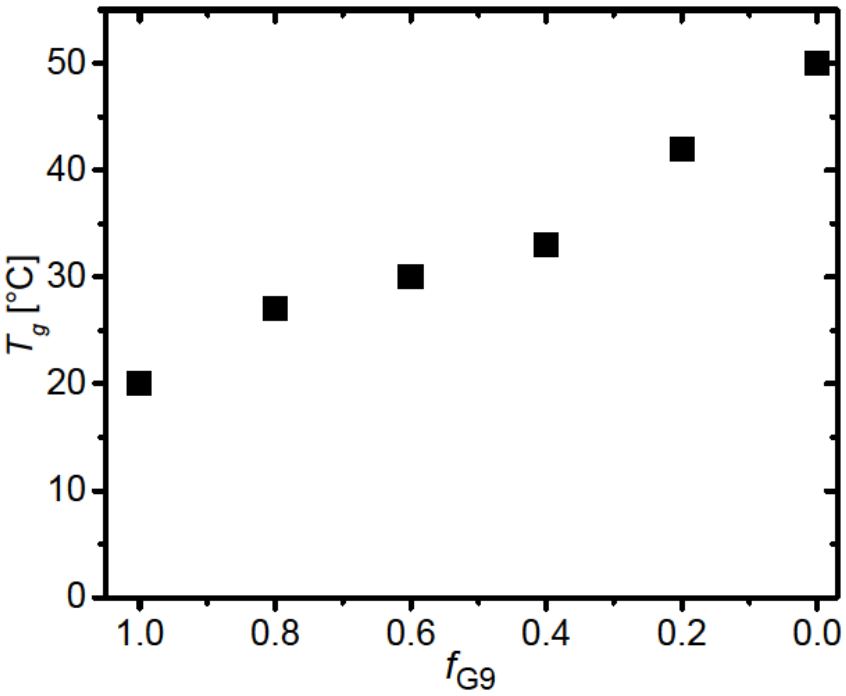

Figure S3: Glass transition temperature T_g as a function of the G9/E3 mixing ratio f_{G9}.

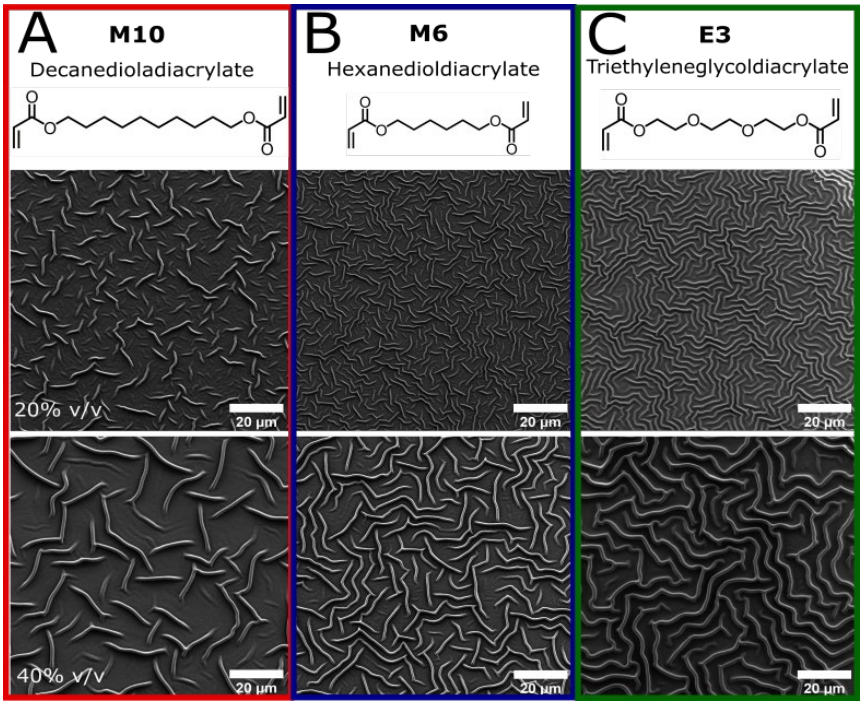

Figure S4: Chemical structures of three acrylates and the corresponding SEM images of films obtained after plasma treatment for two solution concentrations.

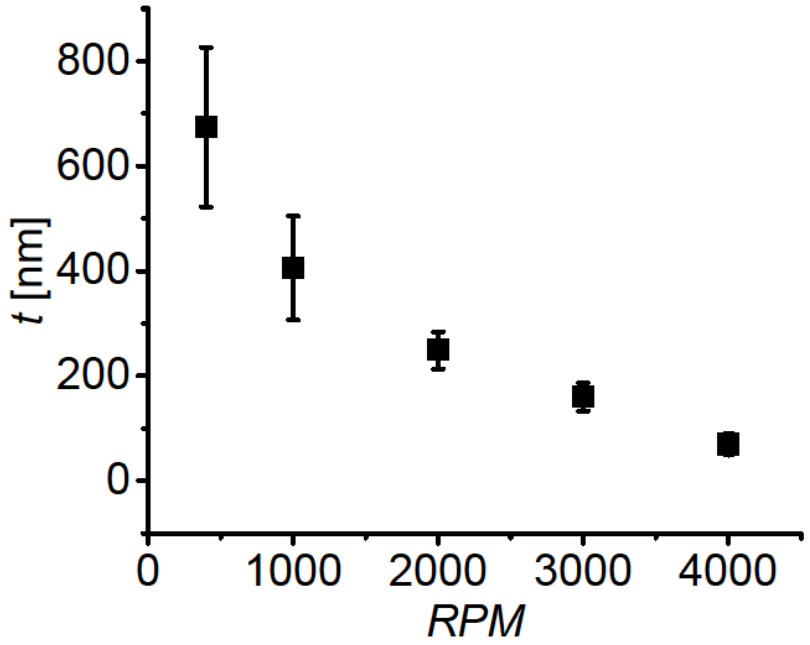

Figure S5: Film thickness t as a function of spin-coating speed for films coated from a 20% v/v monomer solution concentration.

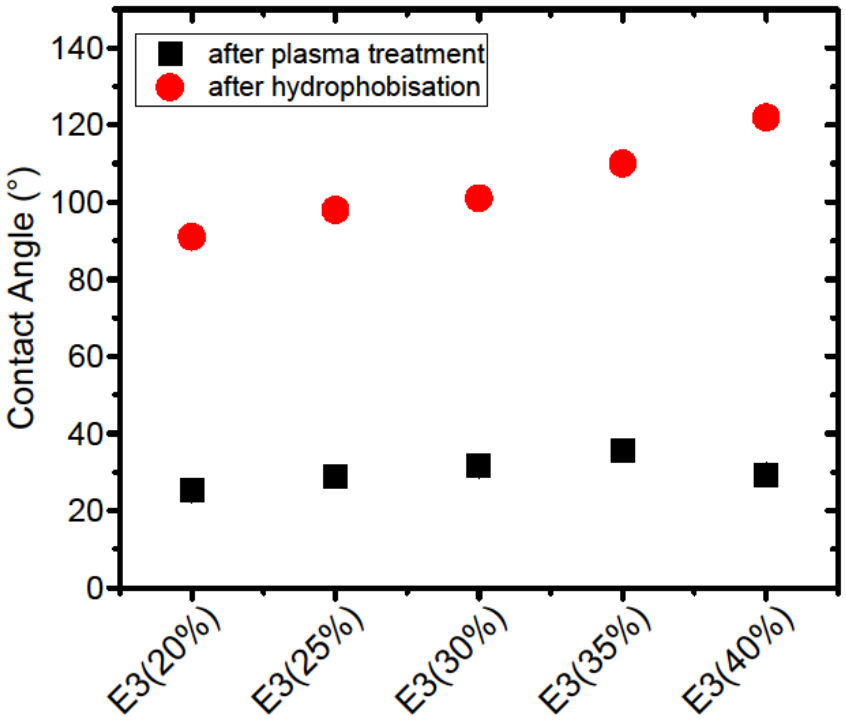

Figure S6: Static water contact angles of water droplets on wrinkled polymer surfaces cast from solutions with varying E3 concentrations, as prepared and after hydrophobisation.

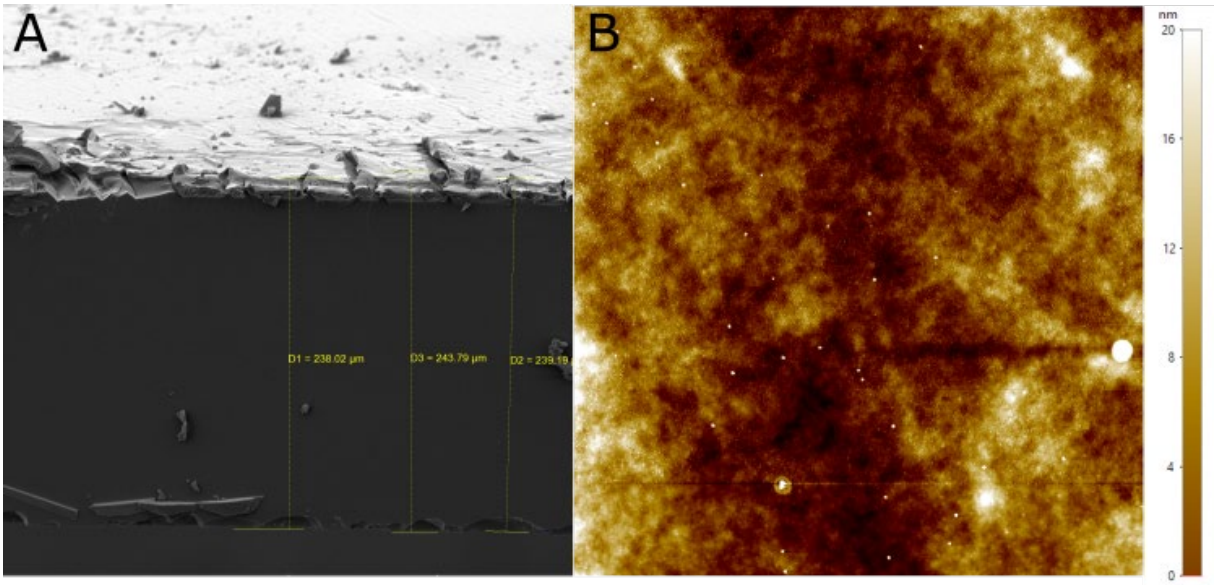

Figure S7: (A) SEM micrograph of crosssection of a thermally polymerized E3 film. (B) AFM image of the surface of a thermally polymerized E3 film.

The flat polymer film was obtained as follows. Similar to the preparation of wrinkled surfaces, a solution of pure E3 diacrylate containing 2.5 % w/v of thermal initiator azobis(isobutyronitril) (AIBN) was prepared and drop-casted onto a glass substrate (5 x 5 cm). It was then immediately placed into a nitrogen-flushed pre-heated oven set to 72 °C and allowed to cure under a nitrogen blanket for 3 hours. The polymerization was quenched by introducing air to the oven chamber and cooling the sample. The sample thickness was measured by SEM (t= 240 nm) and the roughness (R_a = 4 nm) was determined by AFM.

Elastic buckling theory

The buckling theory by Cerda and Mahadevan[1], relates A and λ,

$$A = \frac{\sqrt{2}}{\pi\left(\frac{1}{\varepsilon - \varepsilon_c}\right)^{\frac{1}{2}}}\lambda, \qquad (S1)$$

with ε and ε_c the applied and the critical strains, respectively. A further expression relates the wrinkle amplitude, strain and film thickness, [2]

$$A = t\sqrt{\frac{\varepsilon - \varepsilon_c}{\varepsilon_c}} \qquad (S2)$$

Equation (1) is obtained by combining equation (S1) with equation (S2), resulting in a relation between ε_c and t.

Calculation of Relative Traction Forces

Relative traction forces as displayed in Figure 3 were calculated as follows:

$$F_{rel} = \frac{F_s}{F_g} \qquad (S3)$$

With F_{rel} displaying relative traction force, F_s traction forces measured on wrinkled/flat samples and F_g traction forces measured on glass reference surfaces, respectively.

Supplementary References

1. Cerda, E. & Mahadevan, L. Geometry and Physics of Wrinkling. *Phys. Rev. Lett.* **90**, 4 (2003).
2. Chung, J. Y., Nolte, A. J. & Stafford, C. M. Surface wrinkling: A versatile platform for measuring thin-film properties. *Adv. Mater.* **23**, 349–368 (2011).