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 $\lambda$ and the resulting aspect ratio $AR$ for the three different acrylate films of Figure S4, for a monomer solution concentration of 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  |
| $\lambda$ [µm] | 10.97 ± 5.27   | 3.39 ± 1.47  | 2.33 ± 0.39  |
| $A/\lambda$ | 0.05            | 0.13         | 0.24         |

Table T2: Film thickness $t$, wrinkle amplitude $A$, wavelength $\lambda$ and the resulting aspect ratio $AR$ for the three different acrylate films of Figure S4, for a monomer solution concentration of 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   |
| $\lambda$ [µm] | 12.67 ± 7.02   | 4.09 ± 1.15  | 5.08 ± 0.73  |
| $A/\lambda$ | 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.

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.

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Figure S2: FTIR spectra of E3 monomer film prior to plasma polymerisation and plasma polymerised samples of films cast from various E3 solution concentrations.
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.
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 (Rₐ = 4 nm) was determined by AFM.
Elastic buckling theory

The buckling theory by Cerda and Mahadevan\(^1\), relates \(A\) and \(\lambda\),

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

with \(\varepsilon\) and \(\varepsilon_c\) the applied and the critical strains, respectively. A further expression relates the wrinkle amplitude, strain and film thickness, \(^2\)

\[
A = t \left( \frac{\varepsilon - \varepsilon_c}{\varepsilon_c} \right)
\]

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

Calculation of Relative Traction Forces

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

\[
F_{rel} = \frac{F_s}{F_g}
\]

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).