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Research article

Influence of solvent and molecular weight in wrinkle formation in spin-cast polystyrene thin films

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Supplementary

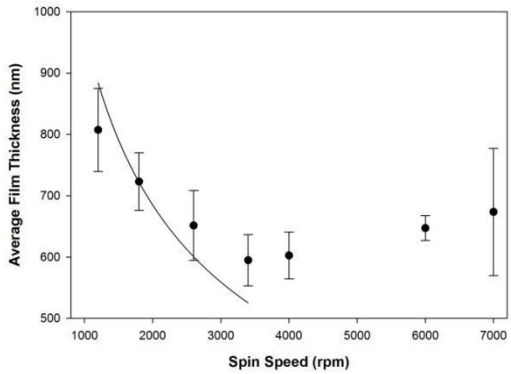

Figure S1. Polystyrene average film thickness as a function of spin speed for molecular weight = 350000 g/mol. The solid line represents a fit of $h = a\omega^{-½}$, where ω is the spin speed. The error bars represent a standard deviation of 4 measurements.

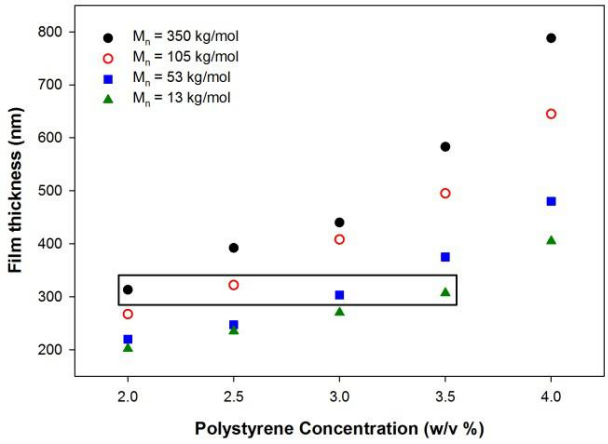

Figure S2. Film thickness as a function of PS concentration spun at 1200 rpm for multiple molecular weights. The box indicates the thickness region of ~310 nm, which can be attained for any molecular weight by adjusting the solution concentration.

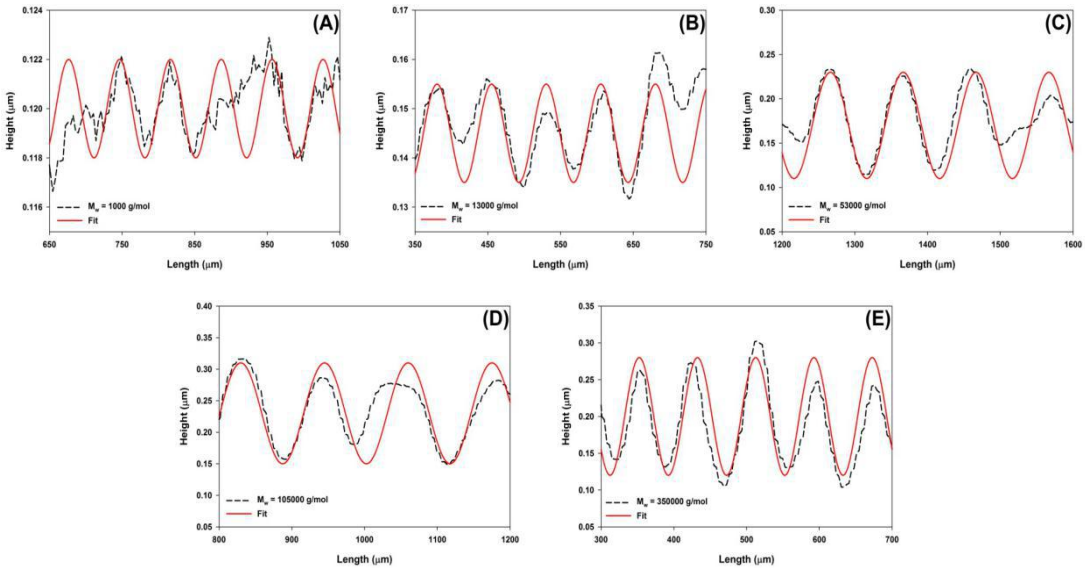

Figure S3. Line scan profiles of the wrinkled polystyrene surface. Black lines are data and the red lines are fits to Eq 2. (a) M_w = 1000 g/mol, a_o = 2 ± 1 nm, λ_o = 65 ± 3 μm; (b) M_w = 13000 g/mol, a_o = 16 ± 4 nm, λ_o = 77 ± 3 μm; (c) M_w = 53000 g/mol, a_o = 56 ± 34 nm, λ_o = 100 ± 1 μm; (d) M_w = 105000 g/mol, a_o = 110 ± 35 nm, λ_o = 114 ± 3 μm; and (e) M_w = 350000 g/mol, a_o = 70 ± 10 nm, λ_o = 76 ± 16 μm. Uncertainties are the standard error of the fit.

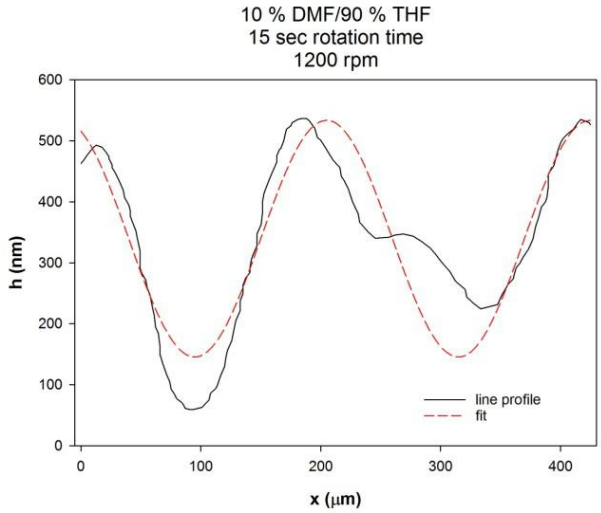

Figure S4. Line scan (black line) and fit to Eq 2 (main text) (red dashed line) for a film formed from a solution composed of 4% (w/v) PS in a solvent composed of 10% DMF and 90% THF (v/v). The spin time was 15 s and the rotation rate was 1200 rpm. The fit parameters are a_o = 194 ± 7 nm and λ_o = 220 ± 2 μm. The uncertainties are the standard error of the fit.

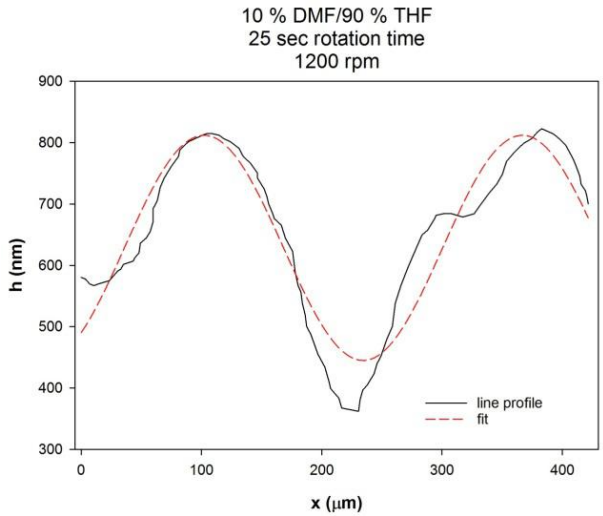

Figure S5. Line scan (black line) and fit to Eq 2 (main text) (red dashed line) for a film formed from a solution composed of 4% (w/v) PS in a solvent composed of 10% DMF and 90% THF (v/v). The spin time was 25 s and the rotation rate was 1200 rpm. The fit parameters are a_o = 184 ± 7 nm and λ_o = 265 ± 3 μm. The uncertainties are the standard error of the fit.

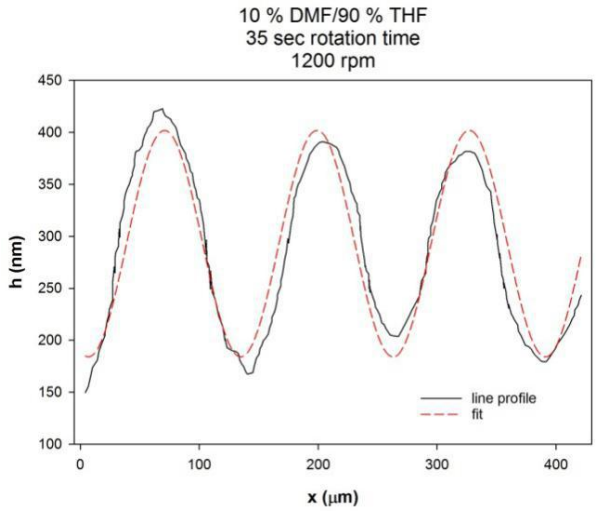

Figure S6. Line scan (black line) and fit to Eq 2 (main text) (red dashed line) for a film formed from a solution composed of 4% (w/v) PS in a solvent composed of 10% DMF and 90% THF (v/v). The spin time was 35 s and the rotation rate was 1200 rpm. The fit parameters are a_o = 109 ± 7 nm and λ_o = 128 ± 1 μm. The uncertainties are the standard error of the fit.

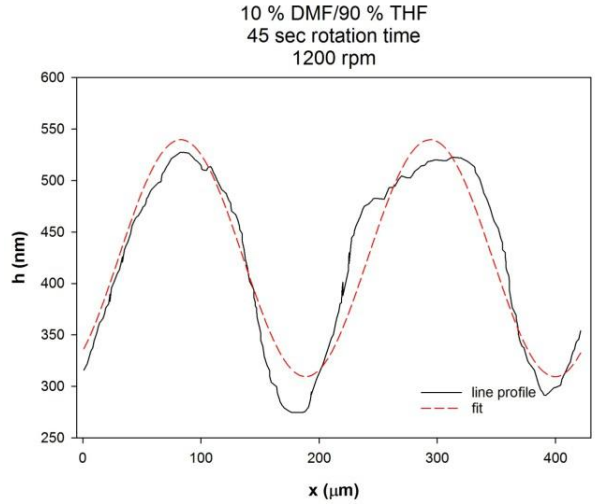

Figure S7. Line scan (black line) and fit to Eq 2 (main text) (red dashed line) for a film formed from a solution composed of 4% (w/v) PS in a solvent composed of 10% DMF and 90% THF (v/v). The spin time was 45 sec and the rotation rate was 1200 rpm. The fit parameters are a_o = 115 ± 3 nm and λ_o = 211 ± 1 μm. The uncertainties are the standard error of the fit.

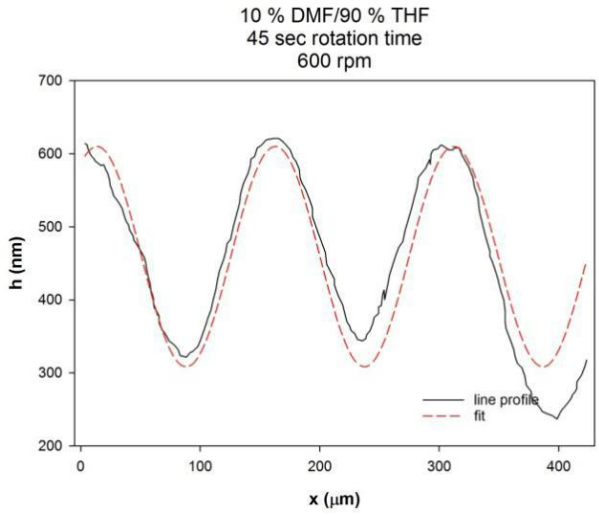

Figure S8. Line scan (black line) and fit to Eq 2 (main text) (red dashed line) for a film formed from a solution composed of 4% (w/v) PS in a solvent composed of 10% DMF and 90% THF (v/v). The spin time was 45 s and the rotation rate was 600 rpm. The fit parameters are a_o = 151 ± 5 nm and λ_o = 149 ± 1 μm. The uncertainties are the standard error of the fit.

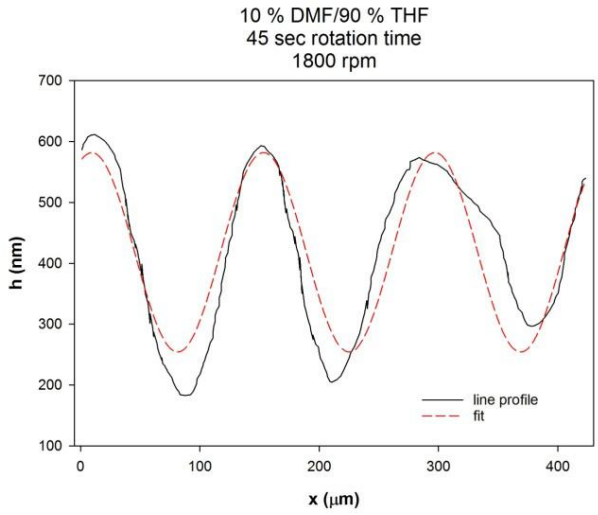

Figure S9. Line scan (black line) and fit to Eq 2 (main text) (red dashed line) for a film formed from a solution composed of 4% (w/v) PS in a solvent composed of 10% DMF and 90% THF (v/v). The spin time was 45 sec and the rotation rate was 1800 rpm. The fit parameters are a_o = 164 ± 5 nm and λ_o = 144 ± 1 μm. The uncertainties are the standard error of the fit.

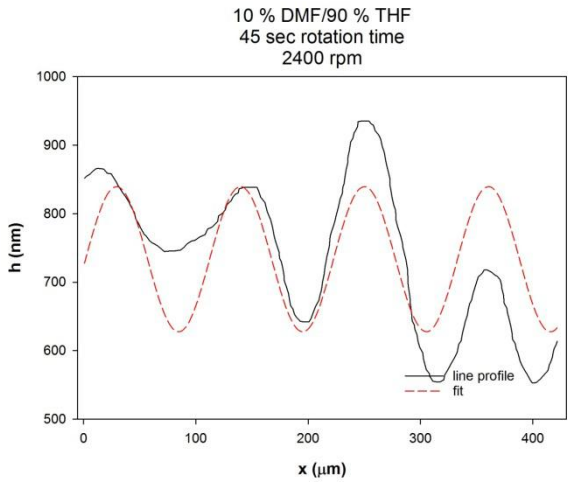

Figure S10. Line scan (black line) and fit to Eq 2 (main text) (red dashed line) for a film formed from a solution composed of 4% (w/v) PS in a solvent composed of 10% DMF and 90% THF (v/v). The spin time was 45 s and the rotation rate was 2400 rpm. The fit parameters are a_o = 106 ± 8 nm and λ_o = 110 ± 1 μm. The uncertainties are the standard error of the fit.

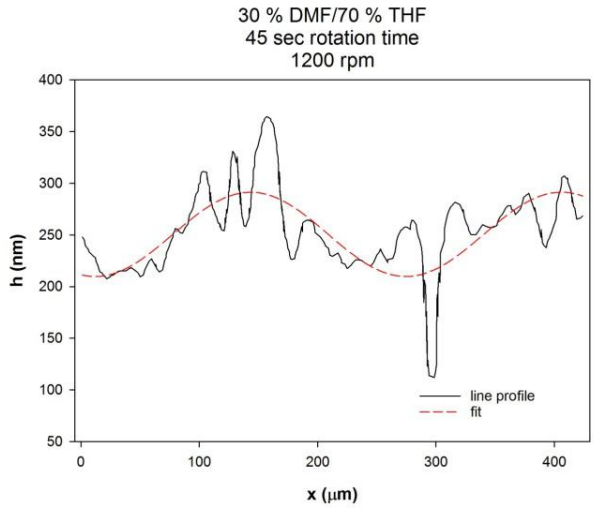

Figure S11. Line scan (black line) and fit to Eq 2 (main text) (red dashed line) for a film formed from a solution composed of 4% (w/v) PS in a solvent composed of 30% DMF and 70% THF (v/v). The spin time was 45 s and the rotation rate was 1200 rpm. The fit parameters are a_o = 41 ± 2 nm and λ_o = 263 ± 6 μm. The uncertainties are the standard error of the fit.

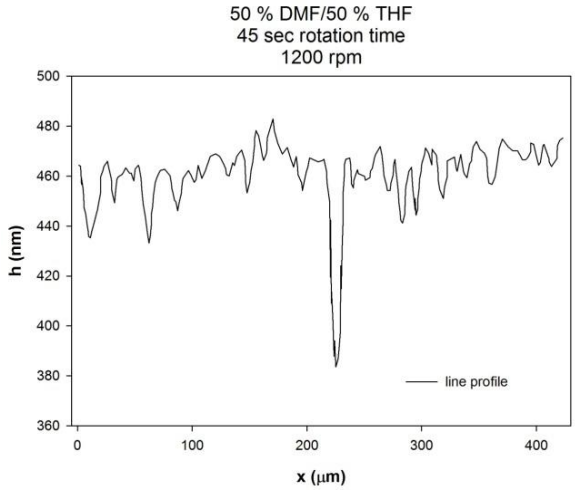

Figure S12. Line scan (black line) and fit to Eq 2 (main text) (red dashed line) for a film formed from a solution composed of 4% (w/v) PS in a solvent composed of 50% DMF and 50% THF (v/v). The spin time was 45 s and the rotation rate was 1200 rpm. An acceptable was not found.

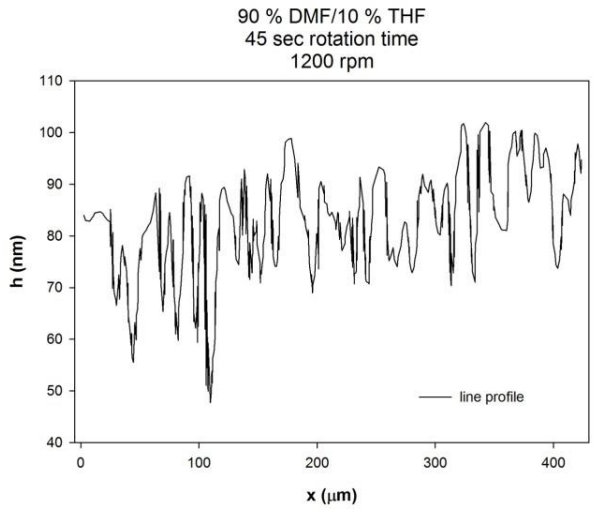

Figure S13. Line scan (black line) and fit to Eq 2 (main text) (red dashed line) for a film formed from a solution composed of 4% (w/v) PS in a solvent composed of 90% DMF and 10% THF (v/v). The spin time was 45 s and the rotation rate was 1200 rpm. An acceptable was not found.