

Supplementary Information

Layer-by-layer naphthalenediimide/Zn phosphonate hybrid films grown from aqueous solutions by a simple deposition technique

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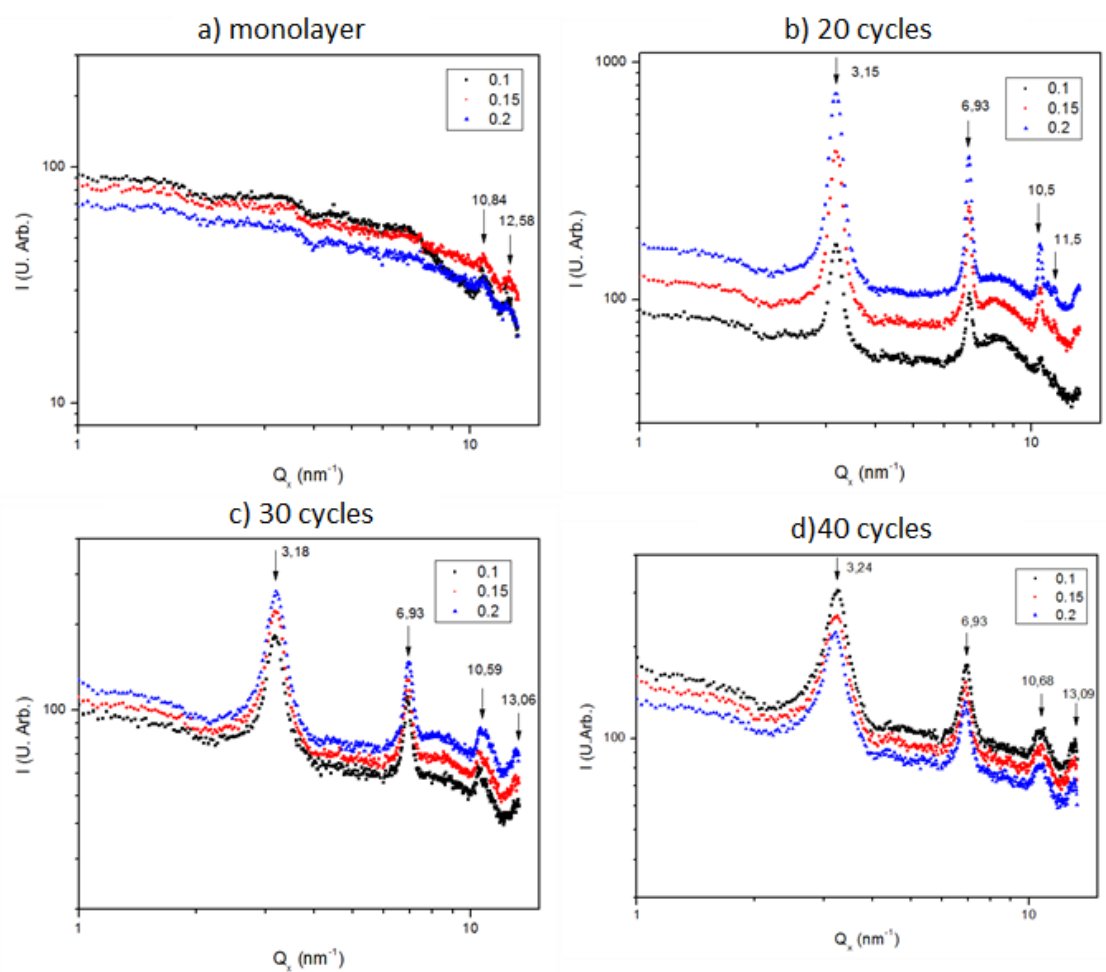


Figure S1. Intensity profiles along the Q_x direction (for $Q_z = 1.5 \text{ nm}^{-1}$) for the PNDI/Zn films acquired with different incidence angles. (a) Monolayer. (b) 20-layer film. (c) 30-layer film. (d) 40-layer film.

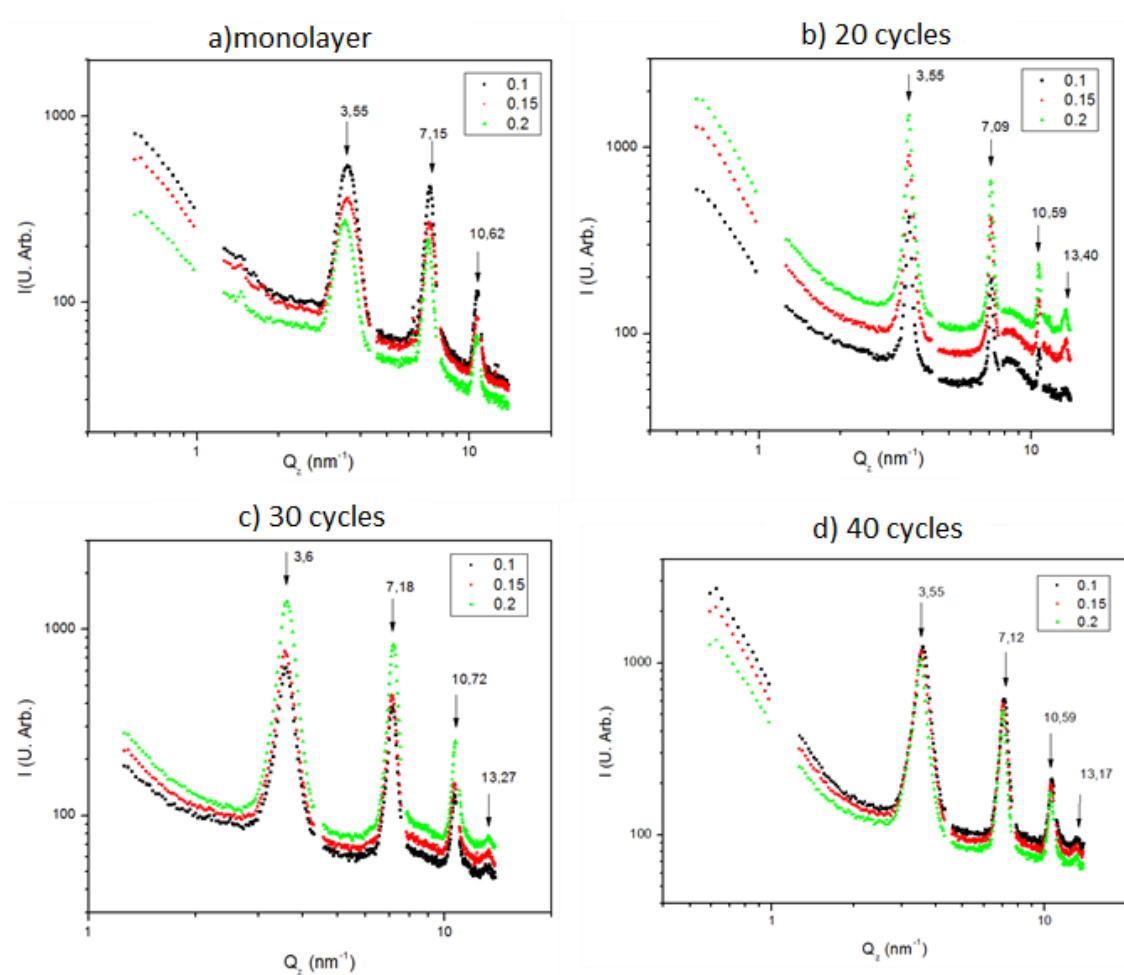


Figure S2. Intensity profiles along the Q_z direction (for $Q_x = -0.5$ nm⁻¹) for the PNDI/Zn films acquired with different incidence angles. (a) Monolayer. (b) 20-layer film. (c) 30-layer film. (d) 40-layer film.

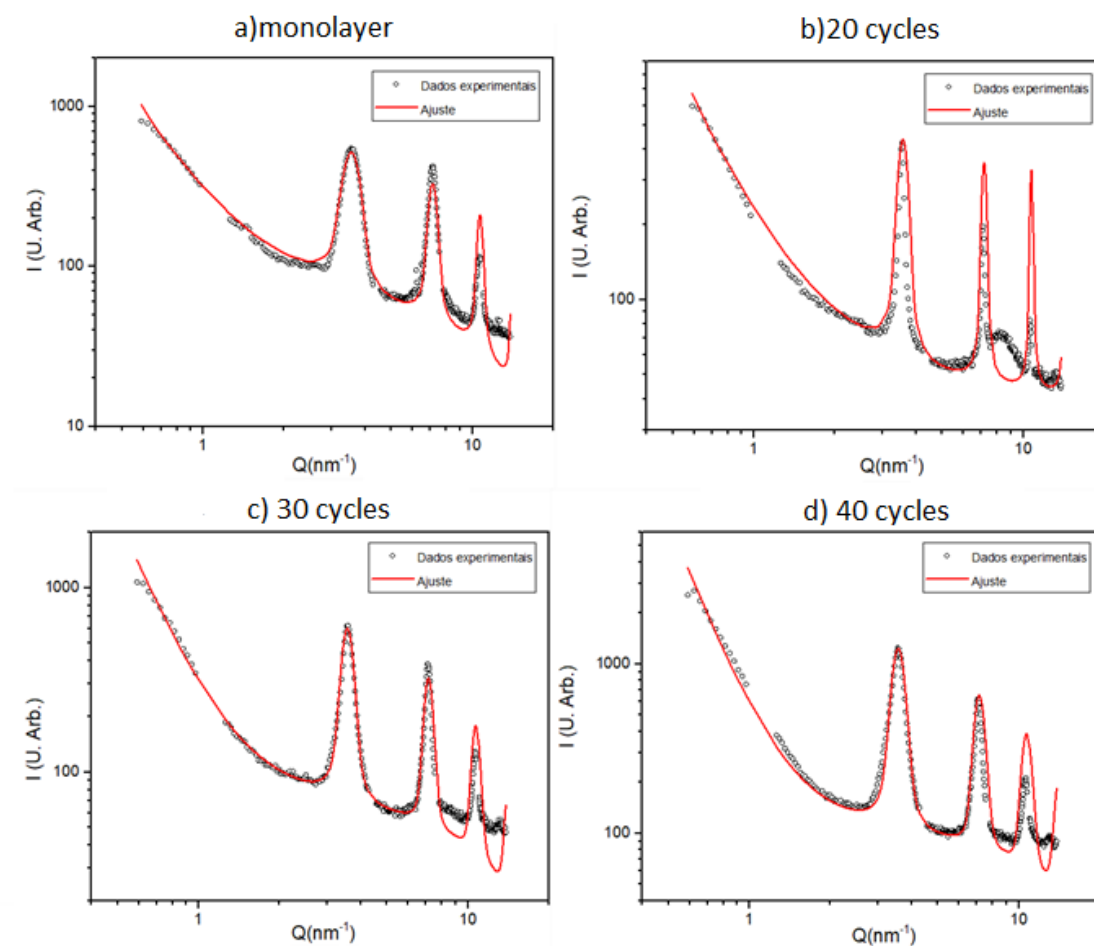
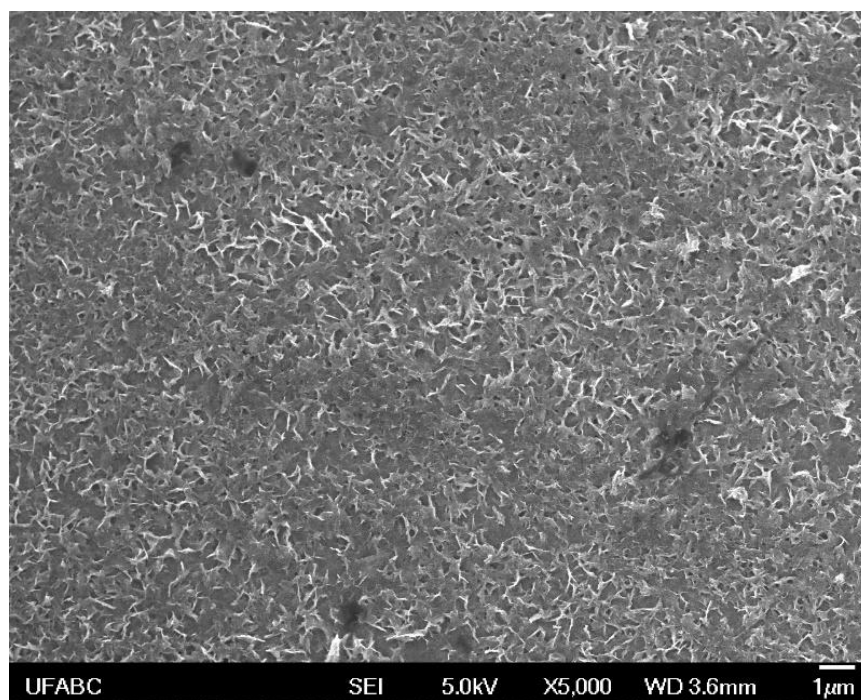
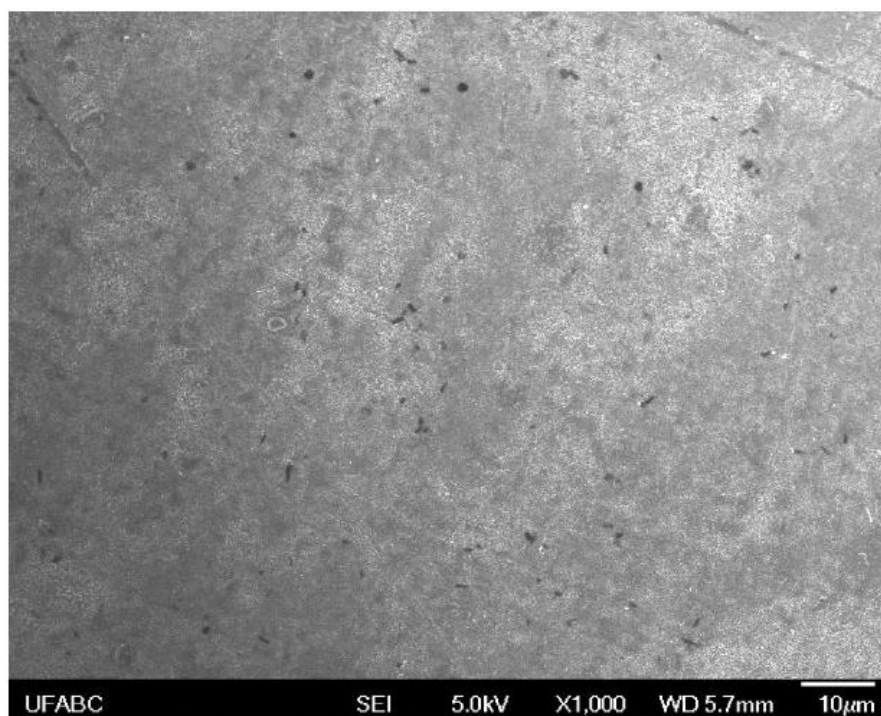


Figure S3. Experimental scattering profiles of the PNDI/Zn films plotted together with the best theoretical adjustment for a lamellar system. The experimental profiles correspond to Figure 4 (Q_z direction, $\alpha_i = 0.10^\circ$). (a) Monolayer. (b) 20-layer film. (c) 30-layer film. (d) 40-layer film.



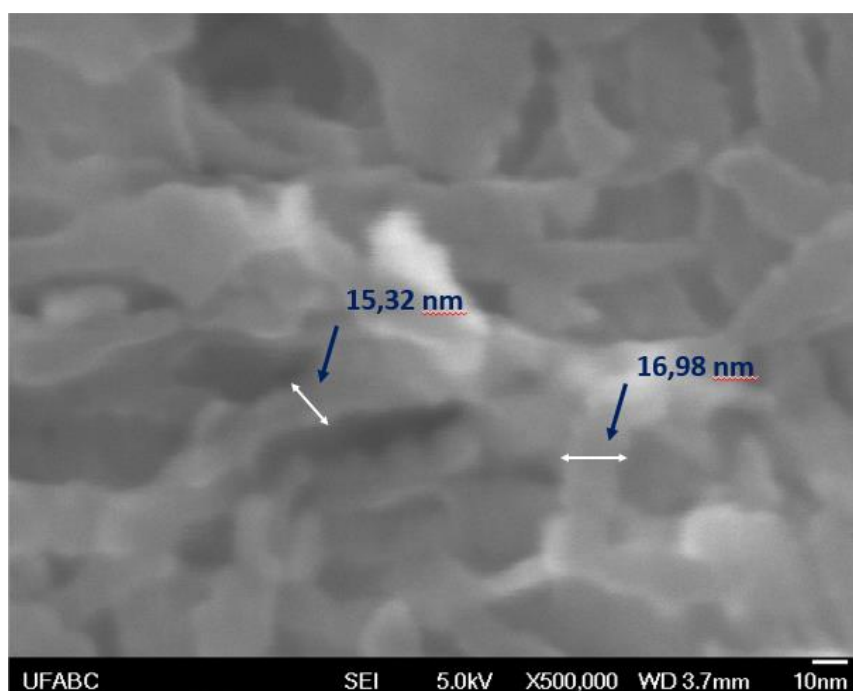


Figure S4. SEM micrographs of the 40-layer PNDI/Zn film in different magnifications.

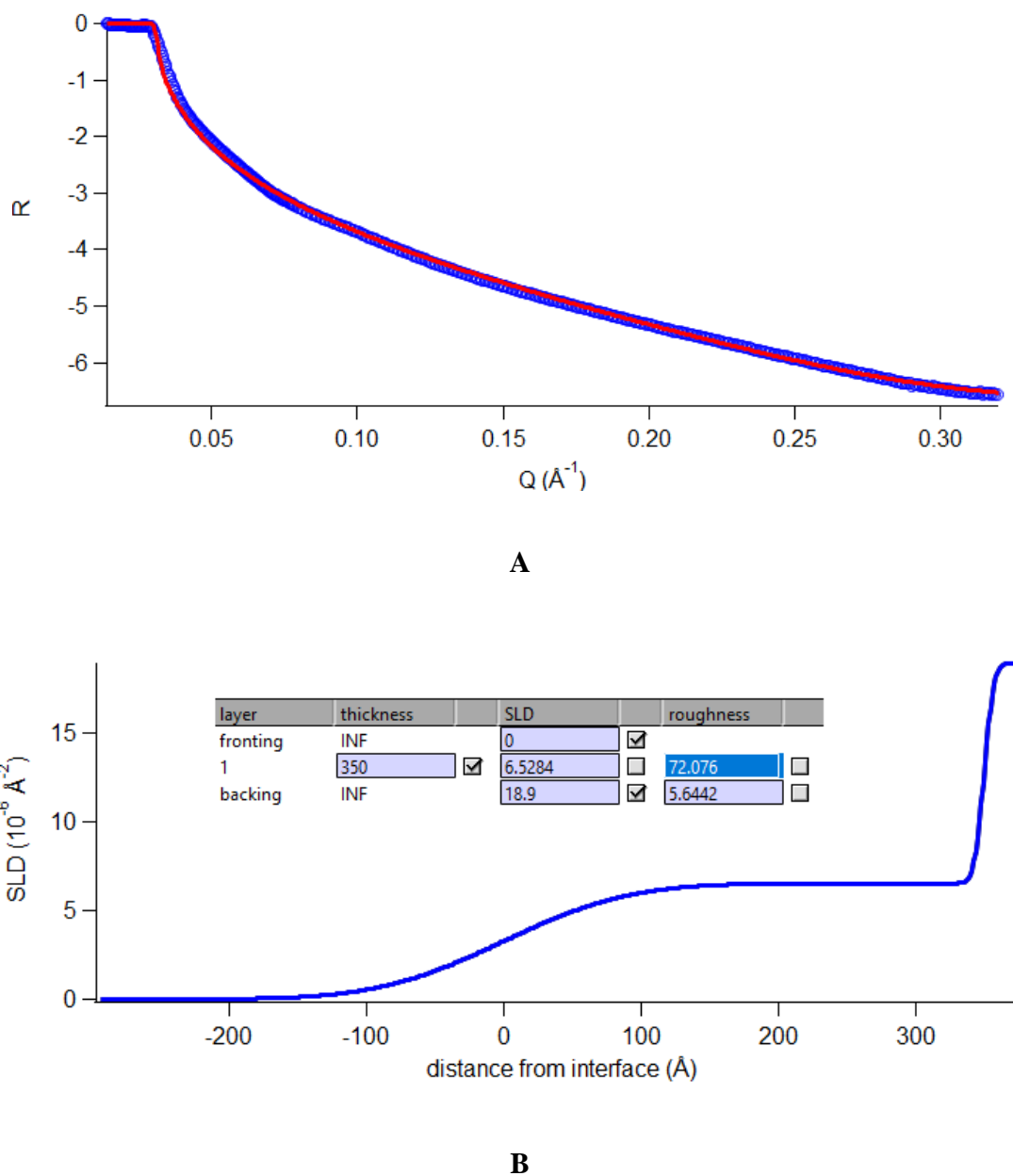


Figure S5. (A) Experimental XRR data for the 20-layer PNDI/Zn film (blue) plotted together with the best fit (red). (B) Scattering length density profile corresponding to the best fit in part A. Inset: Parameters giving the best fit. The checked parameters were fixed in the calculations: Film thickness = 35 nm (from GISAXS, Table S1); $\text{SLD}_{\text{air}} = 0$; $\text{SLD}_{\text{Si}} = 18.9$ (tabulated values, from Motofit software).

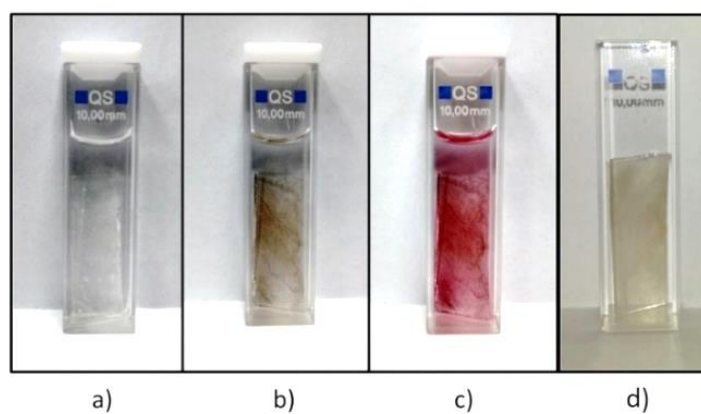


Figure S6. Photographs of the 20-layer PNDI/Zn film. (a) Before reduction. (b) 15 seconds after the start of the reduction. (c) 30 minutes after the start of the reduction. (d) After 24 hours of reduction, the solution was withdrawn and the film was left in contact with air for 30 minutes.

Table S1. Values used as input parameters to obtain the best fit of the experimental scattering profiles (see Figure S3) by the SASfit program.^a

Film	N	d (nm)	t (nm) ^b	Δ	ν
1-layer	4.0	1.76	1.76	0.01	2.7
20-layers	6.5	1.75	35	0.01	7.0
30-layers	8.0	1.75	53	0.05	7.0
40-layers	8.5	1.75	70	0.06	5.0

^a N = average number of stacks; d = layer thickness (interlayer spacing); Δ = stacking disorder parameter; ν = number of uncorrelated dispersion bilayers. ^b Total film thickness (obtained by multiplying the layer thickness d by the number of deposited layers).