Electronic Supplementary Material (ESI) for Nanoscale.

Supporting Information: Showing Particles their Place: Deterministic Colloid Immobilization by Gold Nanomeshes

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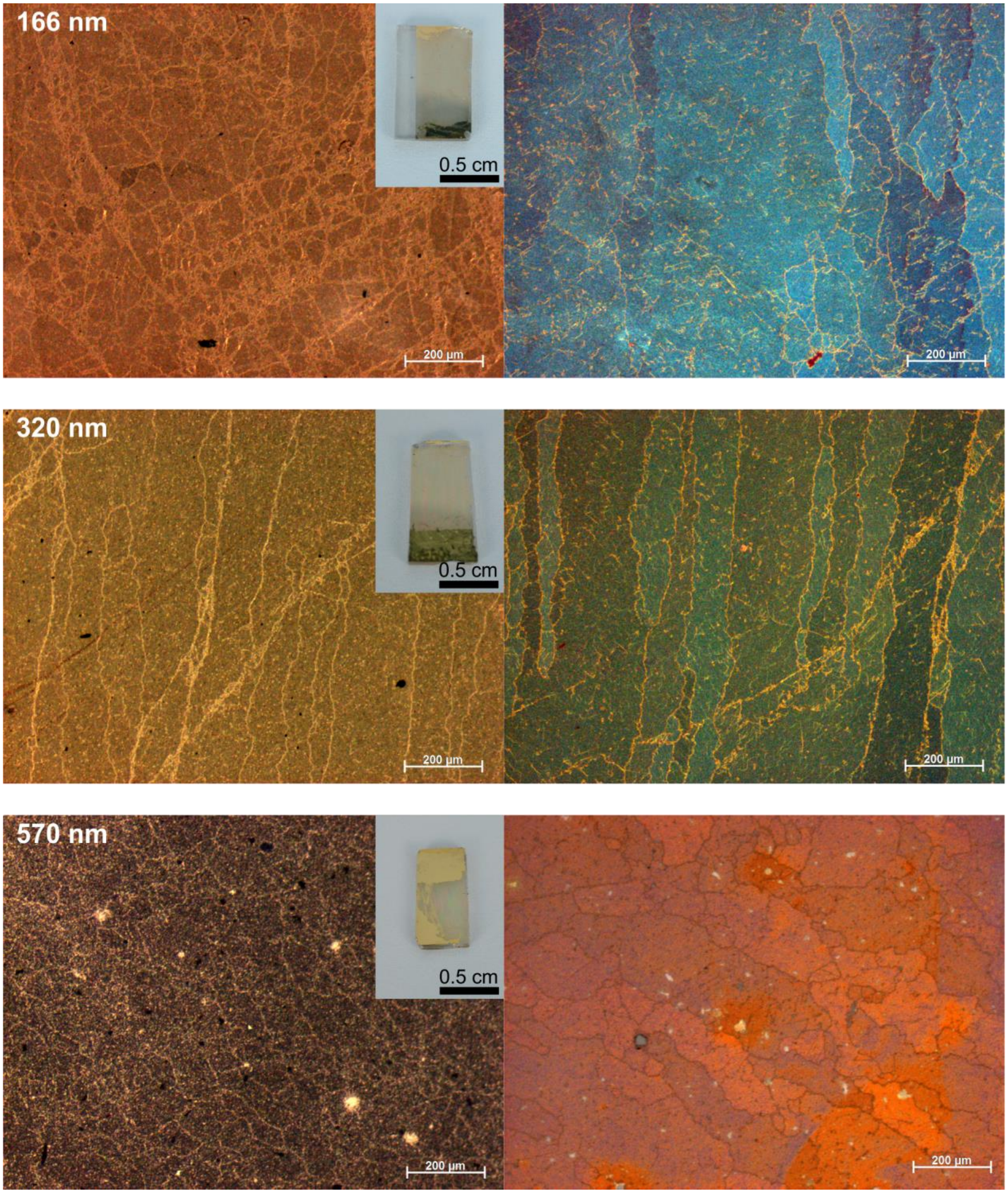
166 nm
0.5 cm
200 µm
200 µm
320 nm
0.5 cm
200 µm
200 µm
570 nm
0.5 cm
200 µm
200 µm

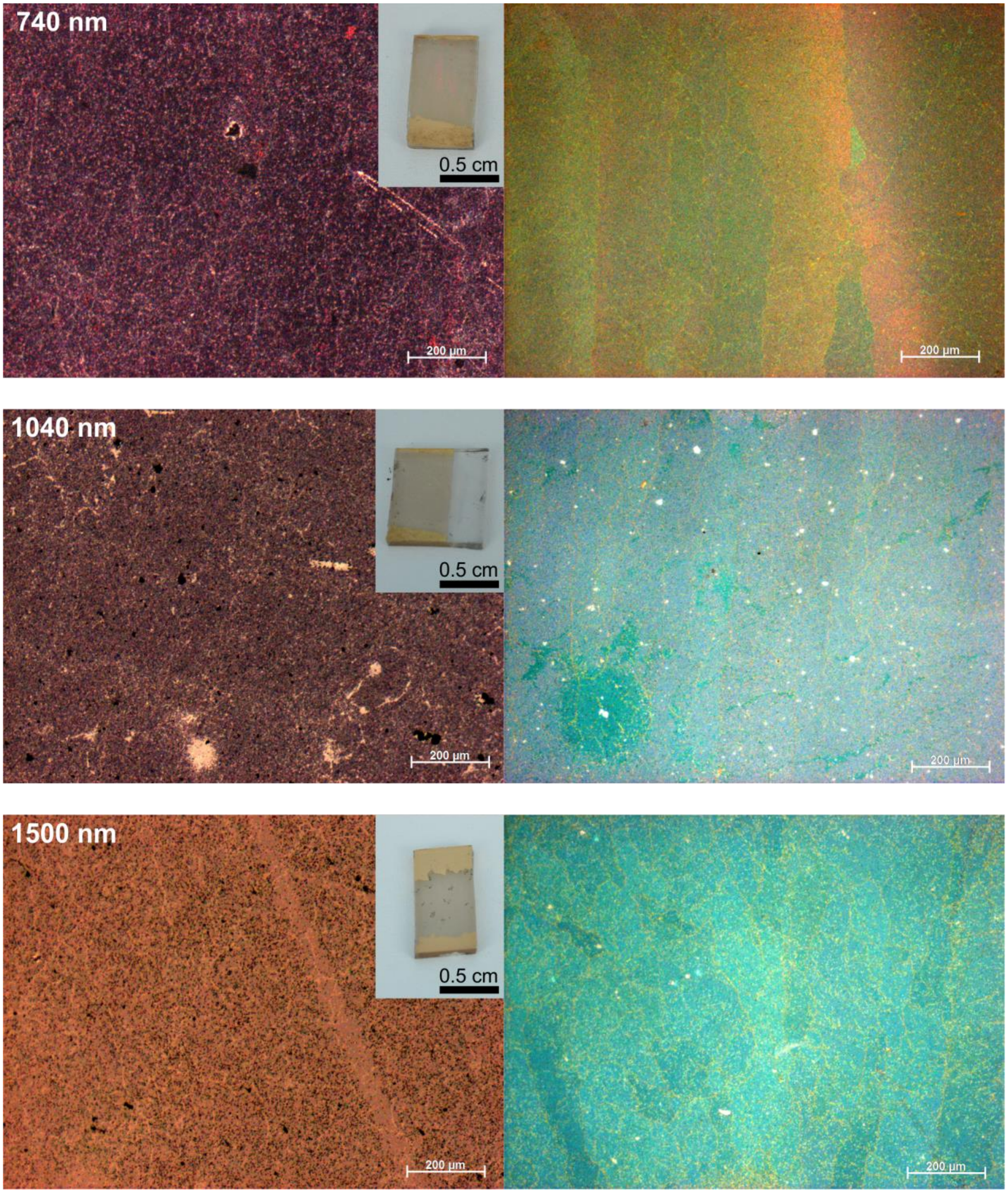

Figure S1. Optical microscopy. Bright field (left) and dark field (right) images of PS particles of different diameter immobilized in nanohole arrays with d_h = 0.87 µm and $L_{h\text{-}h}$ = 1.04 µm. The diameter of the PS particles is indicated at the top left. Insets show a photograph of the samples.

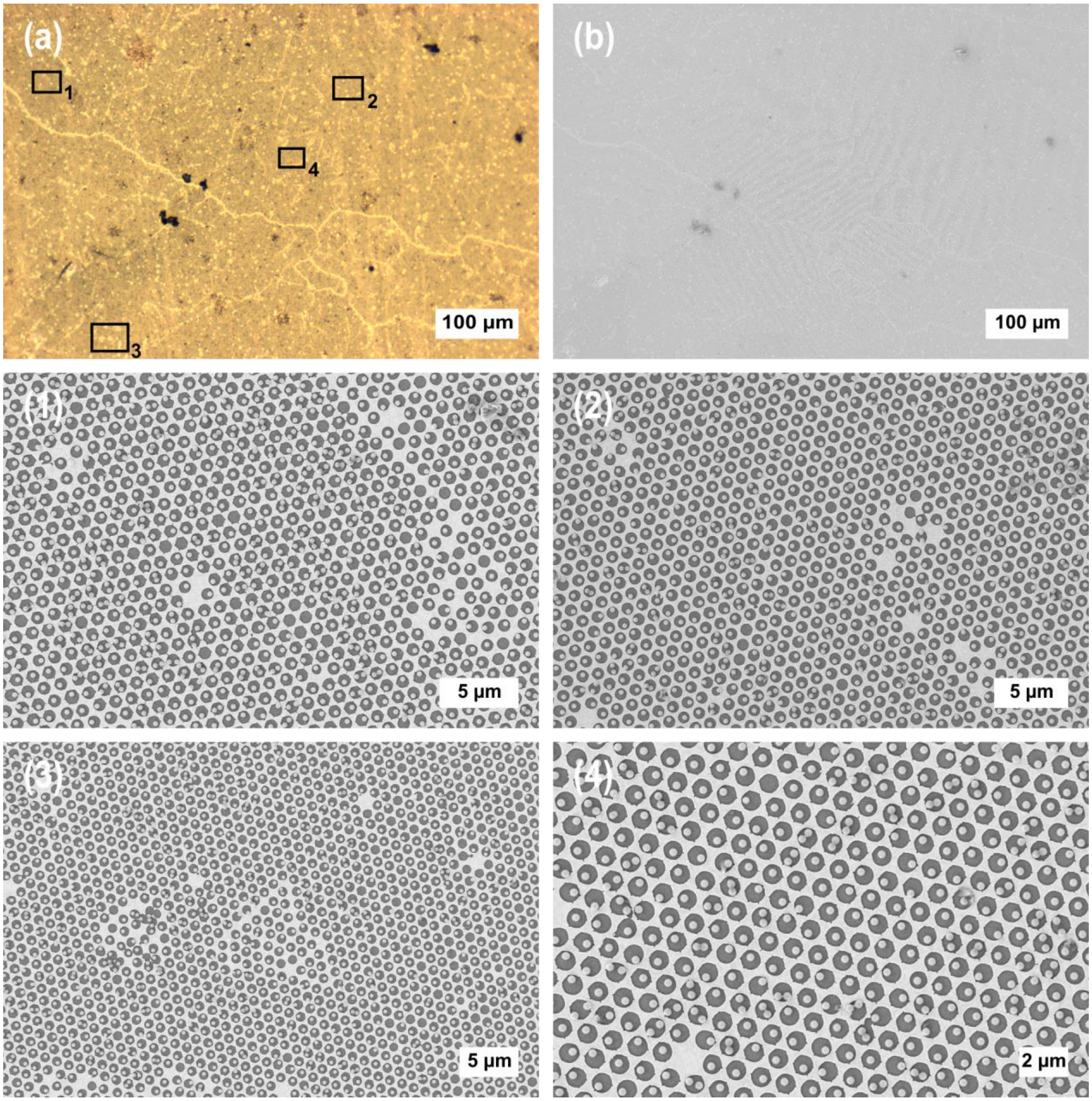

Figure S2. Correlative optical and electron microscopy of 320nm particles adsorbed at pH 5 in a nanohole array with d_h = 0.87 µm and L_{h-h} = 1.04 µm. (a) Optical microscopy and (b) electron microscopy showing the same sample section. (1) – (4) Higher magnification images of the sample spots marked in (a).

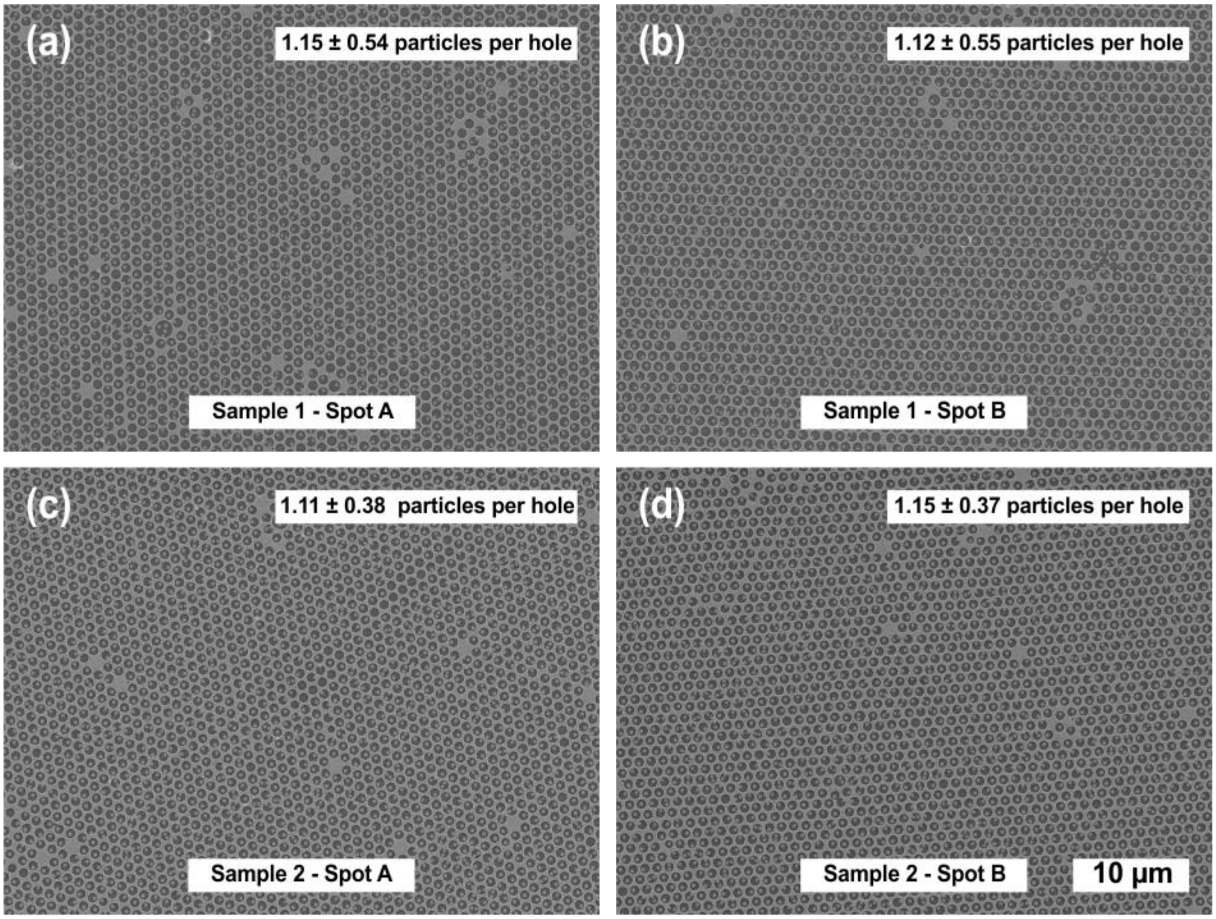

Figure S3. SEM images of 320 nm PS particles assembled on two independent nanohole arrays with d_h = 0.87 µm and $L_{h\text{-}h}$ = 1.04 µm at equal conditions. (a) and (b) are different spots on sample 1, (c) and (d) show independent spots on sample 2.

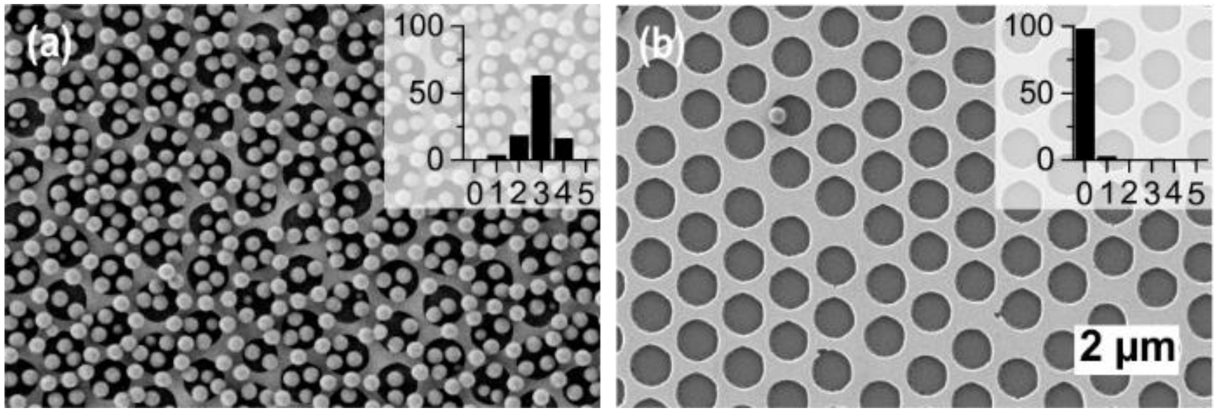

Figure S4. SEM images of 320 nm PS particles adsorbed at (a) pH 3 and (b) pH 12 in nanohole arrays with d_h = 0.87 µm and $L_{h\text{-}h}$ = 1.04 µm. Insets show the frequency distribution of the number of particles per hole in percent.

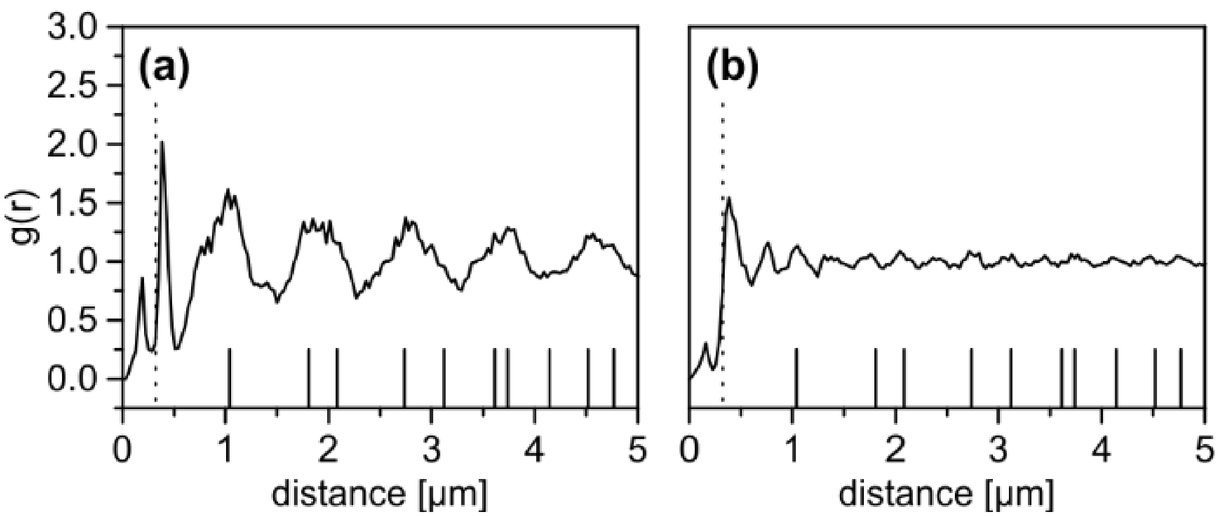

Figure S5. Radial distribution functions g(r) for 320 nm particles immobilized in nanomeshes with d_h = 0.87 µm and $L_{h\text{-}h}$ = 1.04 µm at (a) pH 5 and 1 mM NaCl (b) pH 3 (1 mM HCl). The dotted lines indicate the particle diameter, the solid ticks indicate the g(r) of the underlying Au-nanomesh.

Particle positions were extracted using the “Find Maxima” tool in ImageJ. The radial distribution functions g(r) were calculated using a self-written software. The g(r) was calculated by determining all distances r within the extracted coordinates. These distances were binned to give a histogram of 600 different distance values with a fixed spacing of dr. Then in order to calculate the g(r) from this histogram the area of the circle with a thickness of dr is calculated at every of the 600 bins. The number of particles that are to be expected on average on this area is calculated by multiplying the circle area with the number density. This value is the average number of particles on this area. Then the histogram value that belongs to that dr (or circle area) is divided by this average and the result is the value for the g(r) at rdr.

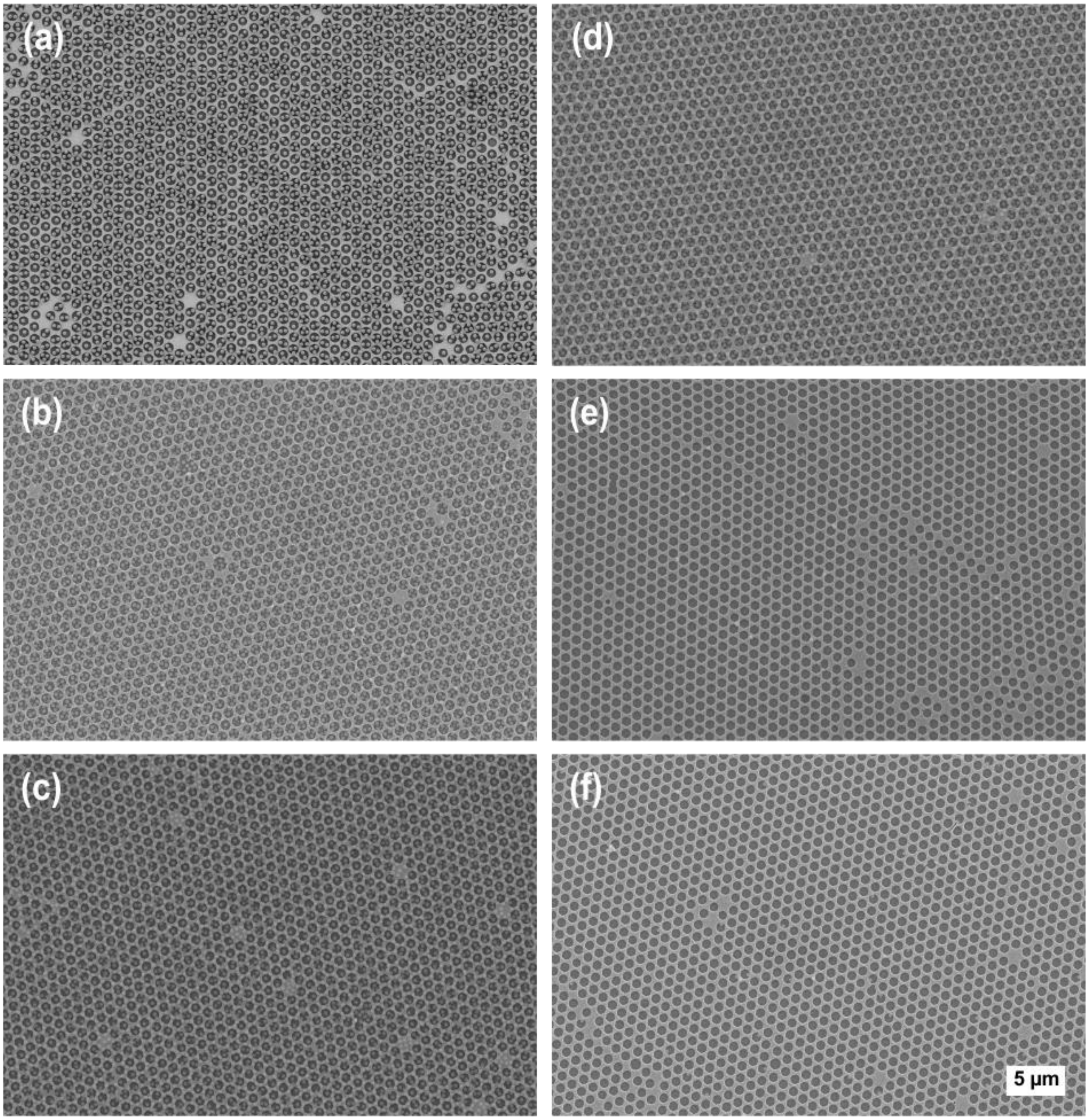

Figure S6. Overview SEM images of 320 nm particles immobilized in nanomeshs with d_h = 0.87 μm and $L_{h\text{-}h}$ = 1.04 μm at (a) pH 5 and 1 mM NaCl, (b) pH 5 and 10 mM NaCl, (c) pH 5 and 100mM NaCl, (d) pH 3, (e) pH 10 and (f) pH 12.

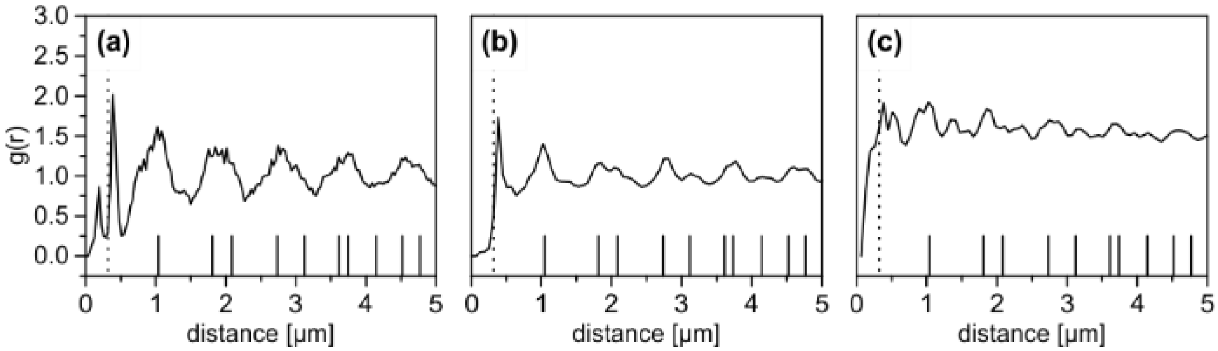

Figure S7. Radial distribution functions g(r) for 320 nm particles immobilized in a nanomesh with d_h = 0.87 µm and $L_{h\text{-}h}$ = 1.04 µm at (a) 1 mM NaCl (b) 10 mM NaCl and (c) 100 mM NaCl. The dotted lines indicate the particle diameter, the solid ticks indicate the g(r) of the underlying Au-nanomesh.

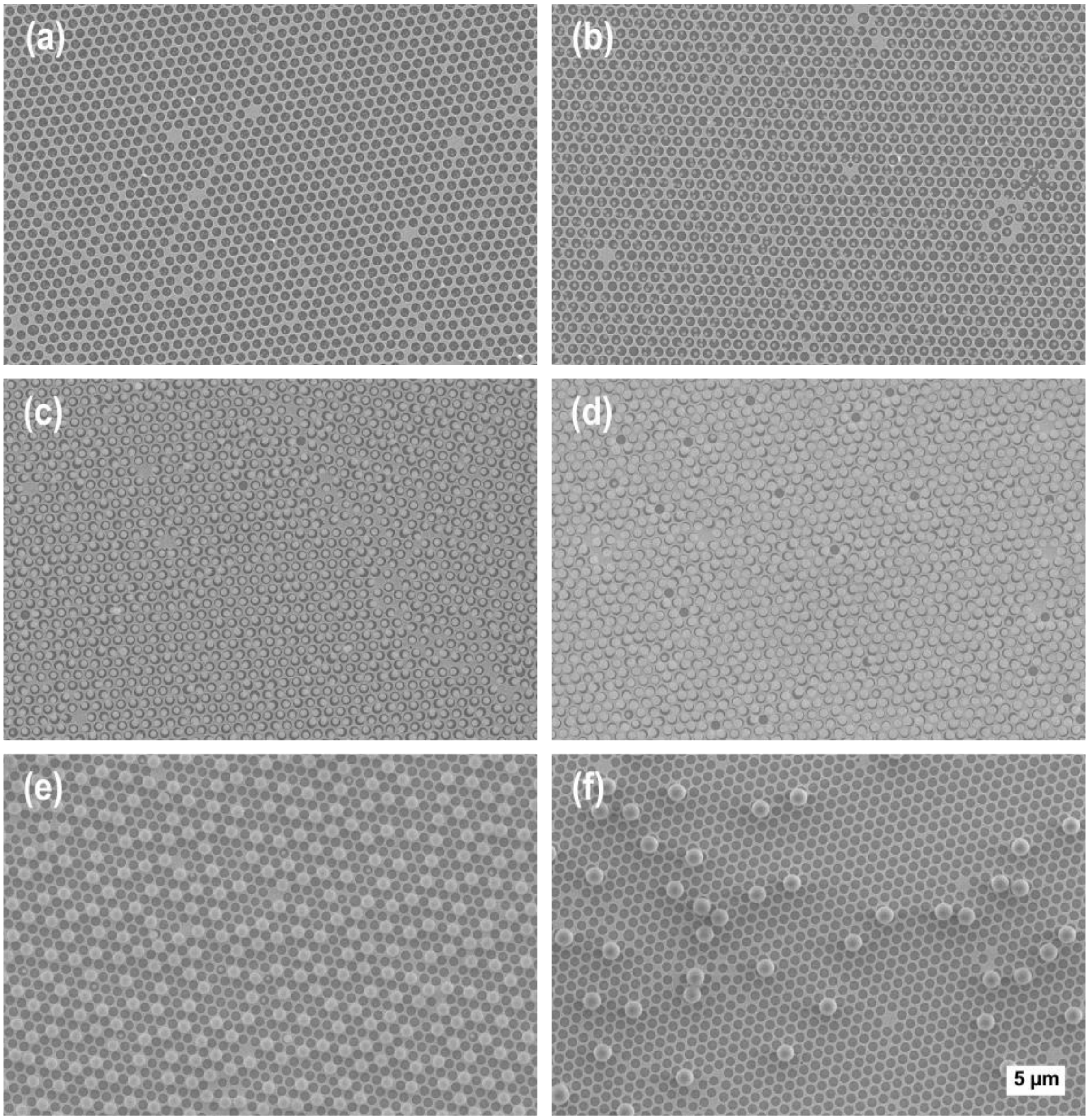

Figure S8. Overview SEM images of PS particles immobilized in nanomeshes with d_h = 0.87 μm and L_{h-h} = 1.04 μm. (a) 166 nm (b) 320 nm (c) 570 nm (d) 740 nm (e) 1040 nm, and (f) 1500 nm.

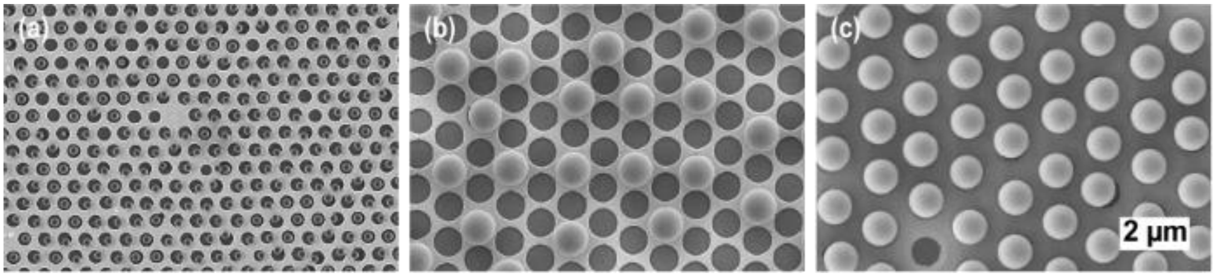

Figure S9. PS particles immobilized in nanohole arrays with variable $L_{h\text{-}h}$. (a) 258 nm particles on a nanomesh with d_h = 0.41 µm and $L_{h\text{-}h}$ = 0.57 µm (b) 1040 nm particles on a nanomesh with d_h = 0.87 µm and $L_{h\text{-}h}$ = 1.04 µm (c) 1040 nm particles on a nanomesh with d_h = 0.83 µm and $L_{h\text{-}h}$ = 1.50 µm.

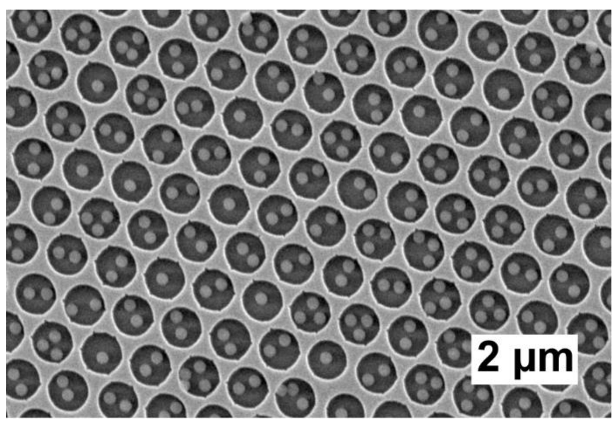

Figure S10. SEM micrograph of 238 nm PMMA particles in a nanohole array with d_h = 0.87 µm and $L_{h\text{-}h}$ = 1.04 µm.

Table S1. Zeta potential of the used PS particles at pH 4.

Partikel	Zetapotential [mV]
166nm	-54
320nm	-39
570nm	-42
740nm	-42
1040nm	-47
1500nm	-51

The zeta potential was measured using a *Zetasizer Nano ZS* (*Malvern*) at 25 °C, a total ionic strength of 10 mM adjusted with NaCl and a particle concentration of 0.001 wt%. The pH was adjusted with HCl and NaOH, respectively.

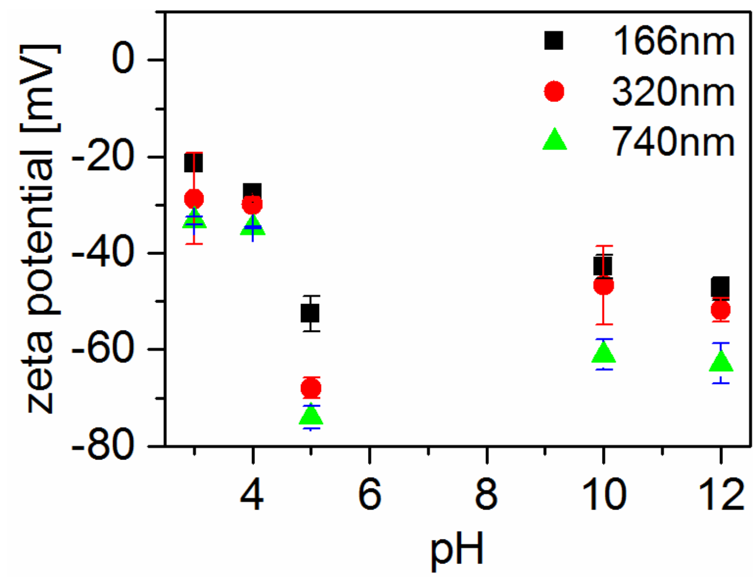

Figure S11. Zeta potential of the PS particles with 166 nm, 320 nm and 740 nm in dependence of the pH.