

Figure S1 XRD curves of the smooth areas of the film and the surface aggregates



Figure S2 pH value detection of each reaction solution, (a) pH = 7.9, (b) pH = 8.2 and (c) pH = 8.5

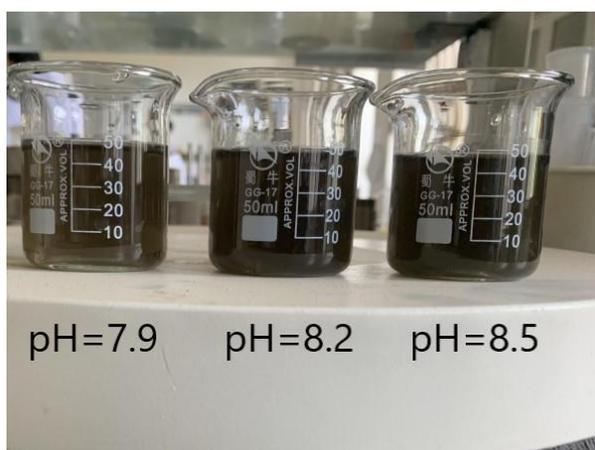


Figure S3 Color comparison of the deposition solutions after 90min in dark environment

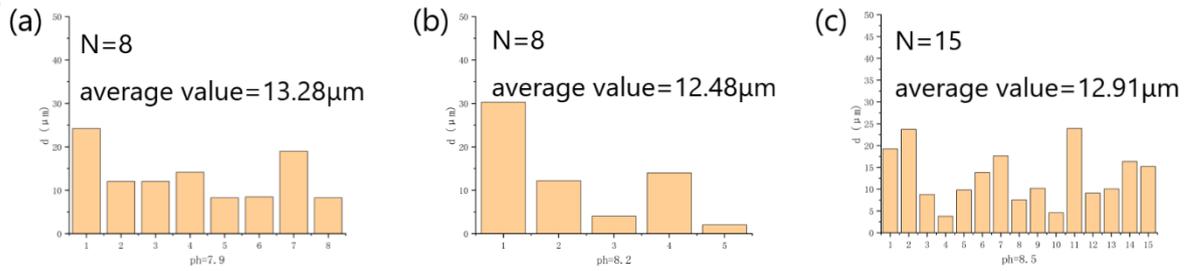


Figure S4 The size and quantity of the aggregates calculated based on the surface SEM images (50×) of the same thickness PDA films deposited for different time length on SiO₂ substrates under (a) pH = 7.9, (b) pH = 8.2 and (c) pH = 8.5

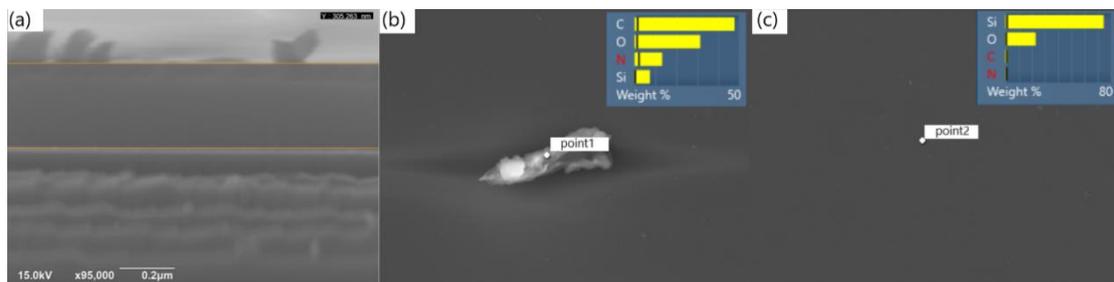


Figure S5 (a) SEM images of cross-sections of the PDA films prepared on SiO₂ substrates at a concentration of 0.5 mg/ml; EDS analysis on (b) the aggregated particle and (c) on the smooth area of the film (without aggregates)

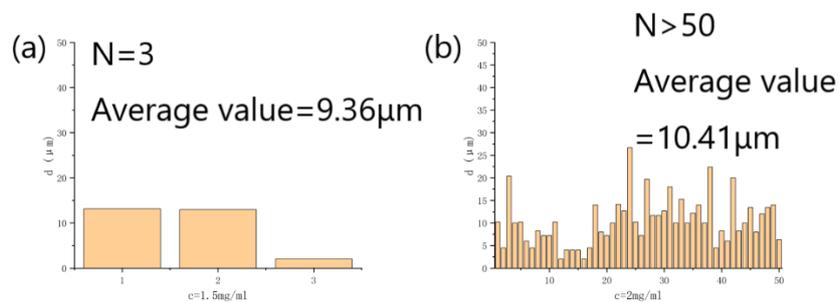


Figure S6 Statistical graph of particle size and quantity of surface aggregates calculated through the 50× magnified SEM images of films deposited under (a) $c = 1.5$ mg/ml and (b) $c = 2$ mg/ml

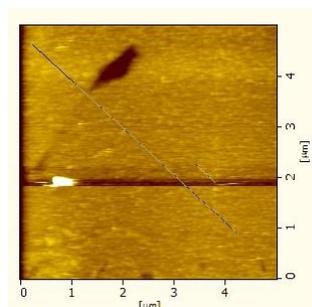


Figure S7 The surface AFM image and the test position for figure 6(g)