Supplementary Material

Sol-gel glass/poly(aniline)/ ITO: An optically transparent,

pH-responsive substrate for supported lipid bilayers

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1. Cleaning of ITO substrates

Unpolished float glass coated with indium tin oxide (R_s = 8-12 Ω, thickness = 120-160 nm) was purchased from Delta Technology Limited (Stillwater, MN). It was cut into 1 inch by 0.7 inch slides. The slides were placed into a 100 mL Coplin jar and soaked in 60 mL dichloromethane for five minutes. The slides then scrubbed with cotton soaked in 1% aqueous Triton X-100 (Aldrich) solution. The slides were then placed back in the Coplin jar, 50 mL of 1% Triton X-100 solution was added, and the vessel was sonicated for 15 minutes. The Coplin jar contents were rinsed several times with deionized water and then sonicated in 60 mL of deionized water for an additional 15 minutes. The deionized water was then decanted and 80 mL of ethanol was added, followed by sonication for 15 minutes. Slides were kept under fresh ethanol until use.

2. Fluorescence Recovery After Photobleaching.

Fluorescence imaging and fluorescence recovery after photobleaching (FRAP) measurements on PSLBs were performed using a Nikon Eclipse TE2000-U microscope. For FRAP, PSLBs composed of egg PC (the blank) or NBD-PC/egg PC (the sample) were formed in the two compartments of a liquid cell. Samples were photobleached in an epi-illumination geometry using the 488 nm line of a Coherent Innova 70 Ar^+ laser at a power of ~ 100 mW, measured before the objective, for < 1 s. Pre- and post-bleach emission intensities were measured using a mercury arc lamp for excitation a Princeton Instruments CCD camera for detection. The laser intensity profile was Gaussian with a half-width at $1/e^2$ of 19-40 μm that was calculated from the first image after photobleaching. Regions of interest (ROIs) inside (I_{in}) and outside (I_{out}) the bleached spot were monitored before and after photobleaching to determine the diffusion coefficients and percent recoveries of the lipid bilayers. To normalize recovery curves, the intensity ratio ($F = I_{in}/I_{out}$) immediately before bleaching was set to 1 and the intensity ratio immediately after bleaching was set to zero. Intensity ratio versus time curves (t = 0 at bleach time) were fit using least squares regression to a single exponential of the form

$$F(t) = A(1-e^{-kt}) + B \quad (1)$$

where F(t) is the intensity ratio of the bleached ROI/unbleached ROI, A and B are fit parameters (% recovery = [A/(1-B)]100), t is time, and k is the apparent rate constant. The diffusion coefficient D was determined from[1]

$$D = \gamma_D \omega^2 / 4\tau_{1/2} \quad (2)$$

where γ_D is a correction factor incorporating the bleach depth (determined to be 1.1 in all cases), ω is the beam half-width at $1/e^2$, and $\tau_{1/2}$ is the half-time for recovery obtained from the fit to equation 1 ($t_{1/2} = (\ln 2)k^{-1}$)).

3. ATR spectroscopy of ITO/PANI/sol-gel electrodes

The absorbance spectra of the two partially oxidized forms of PANI, emeraldine base (EB) and the protonated emeraldine salt (ES), exhibit a pH-dependent response in the 400-900 nm range [1-5]. Here the spectra of ITO/PANI/sol-gel electrodes were measured using broadband attenuated total reflection (ATR) spectroscopy. ATR spectra were acquired after a five minute equilibration time at each pH using a custom built instrument described in previous papers [5, 6]. For the experiments reported here, silica prisms were used to couple a transverse magnetic (TM) polarized light beam from a Xe lamp into and out of the ITO-coated glass substrate. The total internal reflection angle in the substrate was 65-67 degrees. The distance between the incoupling and outcoupling prisms was 40 mm, which produced 9-10 total internal reflections. The outcoupled light was dispersed at a diffraction grating and detected using a Princeton Instruments CCD camera.

Figure S-1 shows the spectra at pH 5 – 9, using the spectrum at pH 4 as a reference. Increasing the pH caused the absorbance of the PANI layer to increase at wavelengths less than 720 nm, which is consistent with deprotonation of ES to form EB [5].

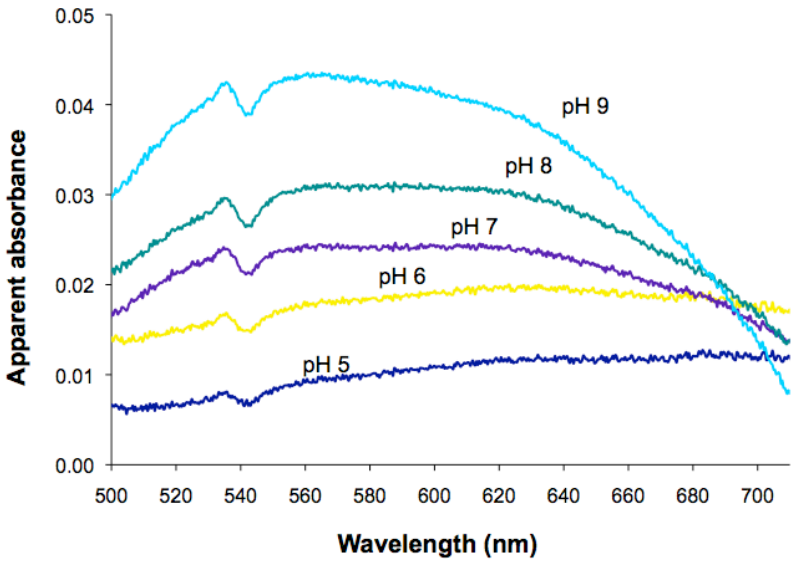

Figure S-1. ATR spectra of an ITO/PANI/sol-gel electrode as a function of pH over the range of 5 to 9. The ATR spectrum at pH 4 was used as the reference to generate apparent absorbance spectra at the higher pH values.

References

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