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Supplementary Information

Nanoporous Photonic Crystals with Tailored Surface Chemistry for Ionic Copper Sensing

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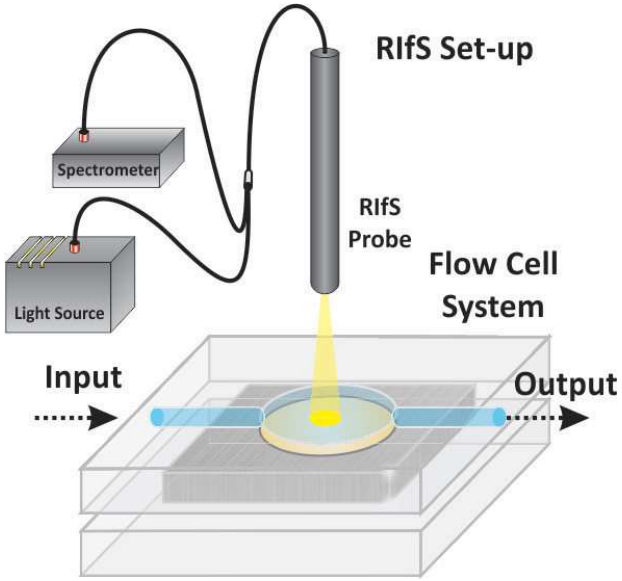

Figure S1. Dynamic flow cell system used to quantify spectral shifts in PEI-GA-PEI-functionalized NAA-GIFs. Reflection spectra were measured using miniature optical fiber spectrophotometers combined with a transparent flow cell based on acrylic plastic to create a microfluidics continuous flow system. The system is composed of a bifurcated optical probe, in which one of the arms carries white light from the tungsten source (LS-1LL, Ocean optics, USA). The optical probe illuminates white light onto the sensing platform over a spot size of ~2 mm in diameter. Subsequently, the reflected light is collected by the other arm (i.e. collection fiber integrated into the same optical probe), which is guided to the miniature spectrophotometer for real-time monitoring and quantification.

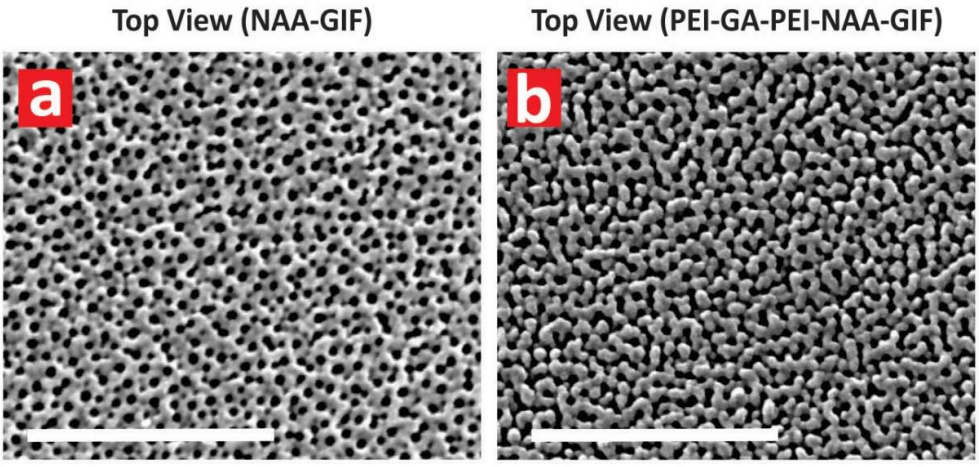

Figure S2. Top view FEG-SEM images of representative NAA-GIFs before (a) and after (b) functionalization with PEI-GA-PEI functional layers (scale bars = 500 nm) (NB: NAA-GIFs fabricated with T_P = 600 s).

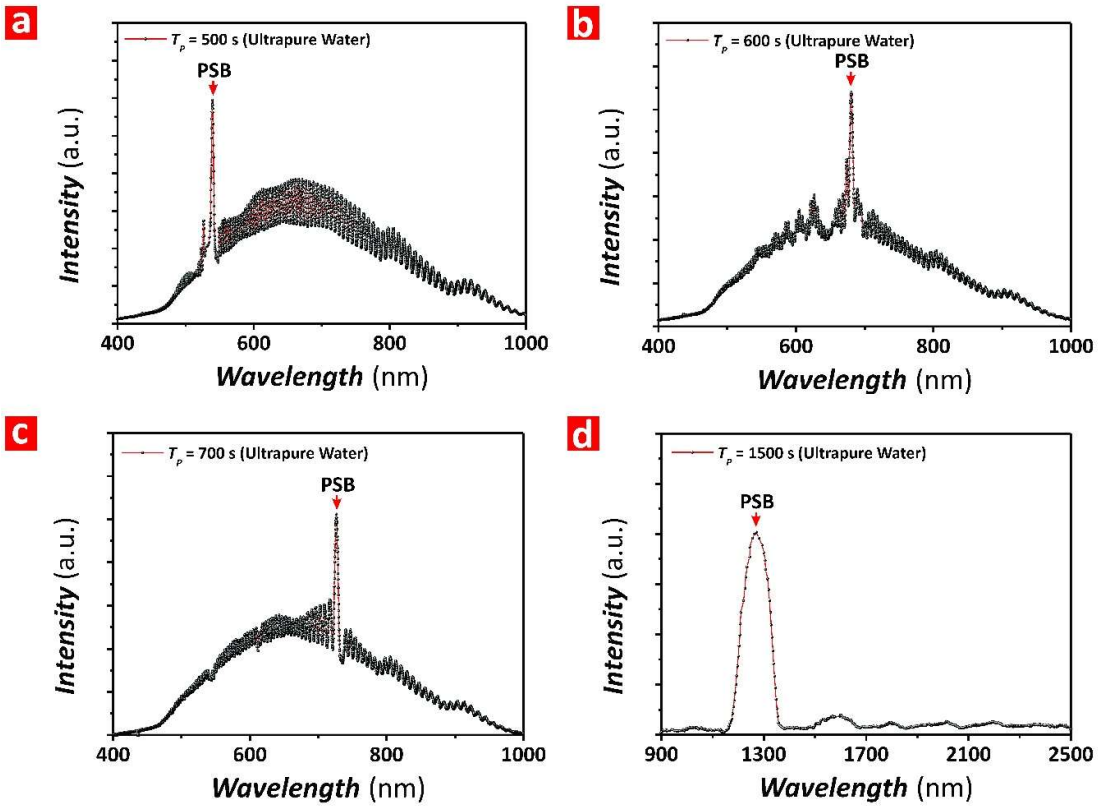

Figure S3. Reflection spectra of NAA-GIFs produced by SPA with varying anodization period, showing the tuneability and resolution of the characteristic photonic stopband (PBS) across the spectral regions, from visible to NIR: a) T_P = 500 s, b) T_P = 600 s, c) T_P = 700 s, and d) T_P = 1500 s (NB: $FWHM_{PSB}$ = 3.87 ± 0.02, 4.74 ± 0.02, 5.46 ± 0.02 and 105.54 ± 1.04 nm for NAA-GIFs produced with T_P = 500, 600, 700 and 1500 s, respectively).

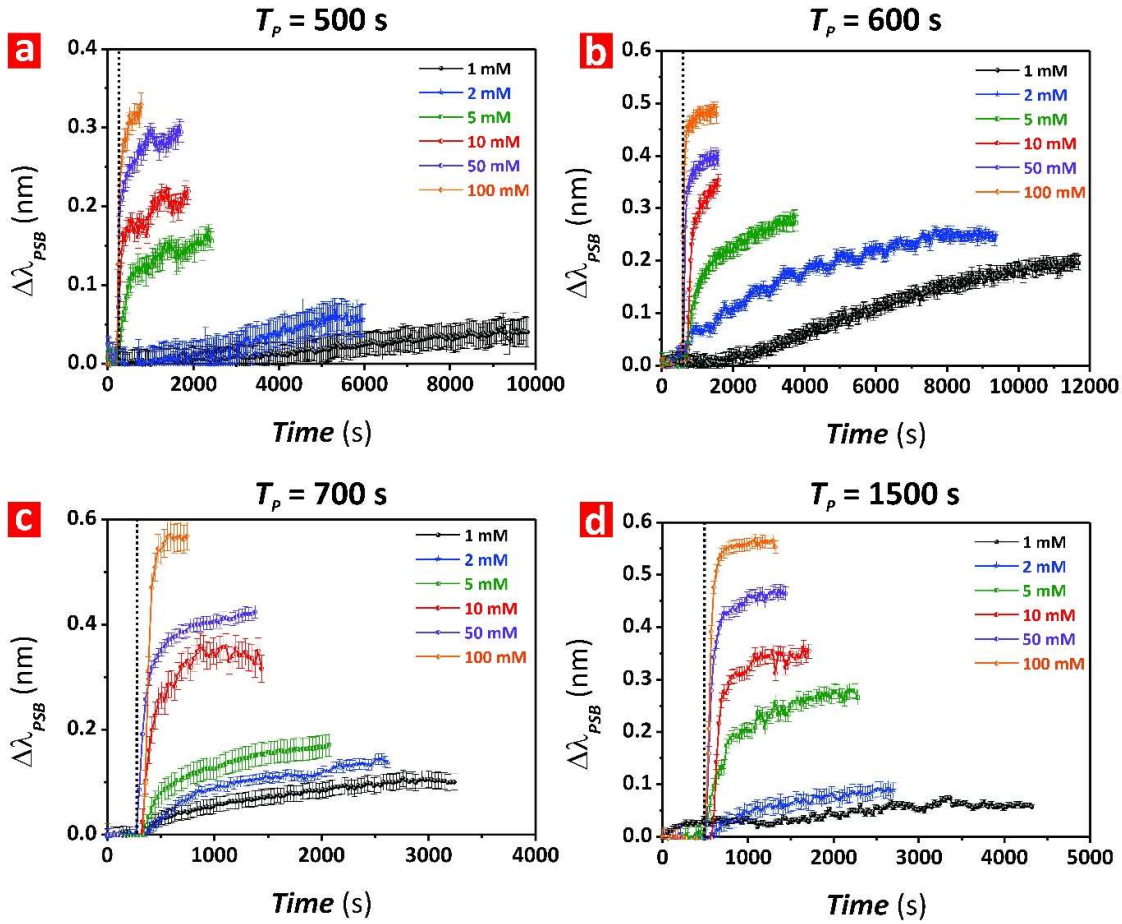

Figure S4. Real-time monitoring of copper ions binding as a function of [Cu^{2+}], from 1 to 100 mM, using $\Delta\lambda_{PSB}$ as sensing parameter in PEI-GA-PEI-functionalized NAA-GIFs produced with: a) T_P = 500 s, b) T_P = 600 s, c) T_P = 700 s, and d) T_P = 1500 s.

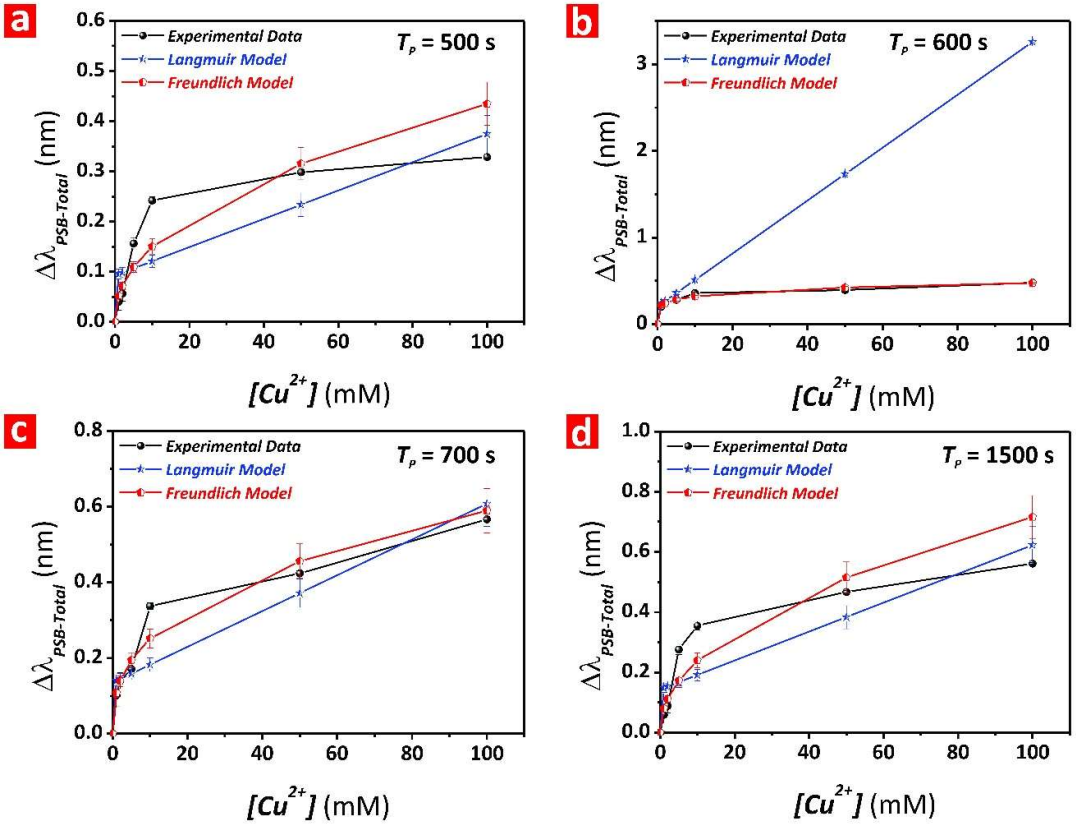

Figure S5. Langmuir and Freundlich isotherm models and experimental data describing the binding mechanism of copper ions by PEI-GA-PEI-functionalized NAA-GIFs produced with: a) T_P = 500 s, b) T_P = 600 s, c) T_P = 700 s, and d) T_P = 1500 s.