

## Supporting Information

### Continuous Monitoring of Glutamate using Electroactive Templated Polymers as Synthetic Molecular Receptors

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## 1. NMR Analysis

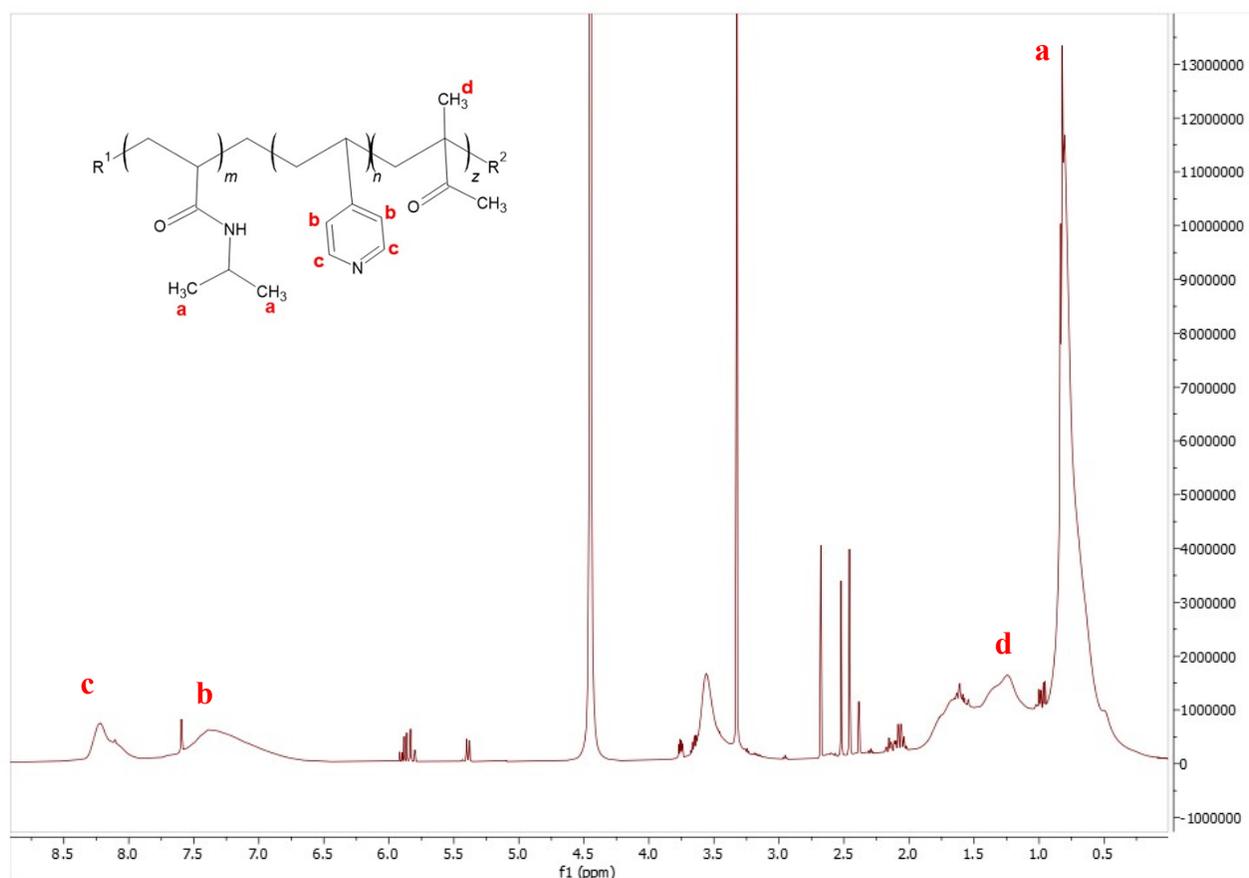


Figure S1.  $^1\text{H}$  NMR spectra of the synthesized poly (NIPAM-VP-MAA) copolymer.

$^1\text{H}$  NMR spectroscopy was employed to confirm the chemical structure of the synthesized polymer. As illustrated in Figure S1, characteristic resonance signals corresponding to the protons of the poly(4-vinylpyridine) (PVP) rings appear at 7.38 and 8.2 ppm. Peaks observed at 0.82 ppm and 1.2 ppm are attributed to the methyl protons of the PNIPAM and poly(methacrylic acid) (PMAA) segments, respectively. Additional signals arise from residual solvents, including  $\text{CDCl}_3$ ,  $\text{H}_2\text{O}$ , and acetone. The molar ratio of the individual polymer segments was subsequently determined using the following equations.

$$\bullet \text{ PNIPAM} = \frac{\frac{I_a/6}{\frac{I_a}{6} + \frac{I_b + I_c}{4} + \frac{I_d}{3}}}{\frac{I_a}{6} + \frac{I_b + I_c}{4} + \frac{I_d}{3}} \times 100 = 71.26\%$$

$$\bullet \text{ PVP} = \frac{\frac{\frac{I_b + I_c}{4}}{\frac{I_a}{6} + \frac{I_b + I_c}{4} + \frac{I_d}{3}}}{\frac{I_a}{6} + \frac{I_b + I_c}{4} + \frac{I_d}{3}} \times 100 = 10.61\%$$

$$\bullet \text{ PMAA} = \frac{\frac{Id}{3}}{\frac{Ia}{6} + \frac{Ib + Ic}{4} + \frac{Id}{3}} \times 100 = 18.13\%$$

From these calculations, the molar ratios of the PNIPAM, PVP, and PMAA segments in the poly(NIPAM-VP-MAA) copolymer were determined as 71.26%, 10.61%, and 18.13%, respectively.

## 2. FT-IR Analysis

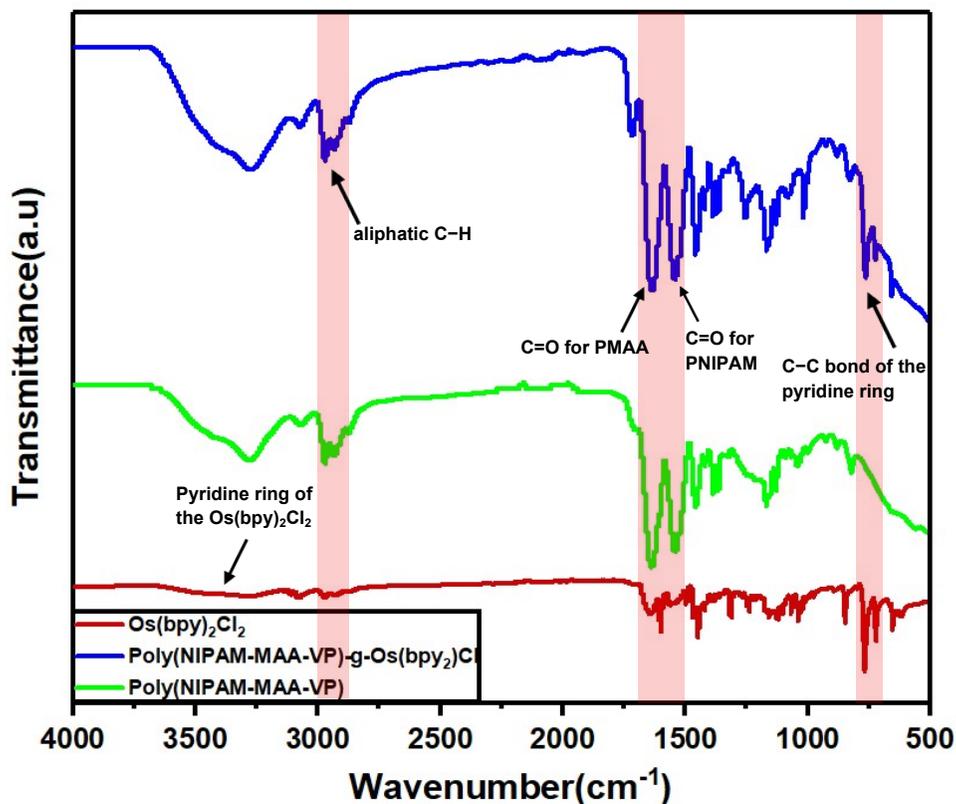
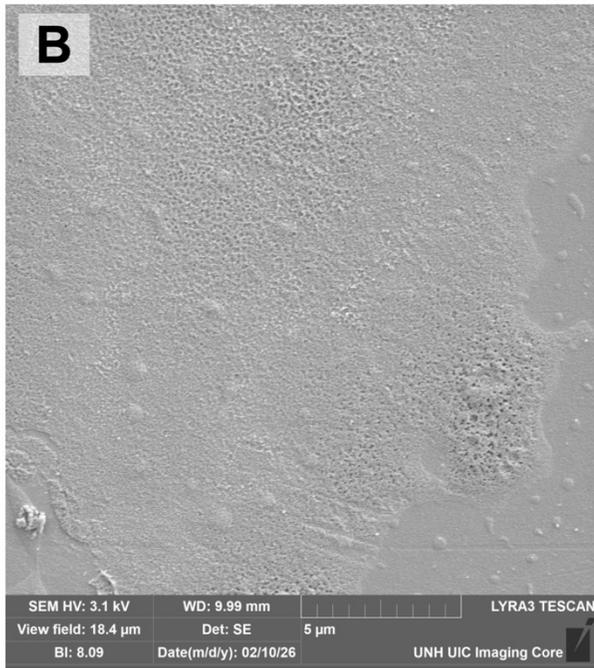
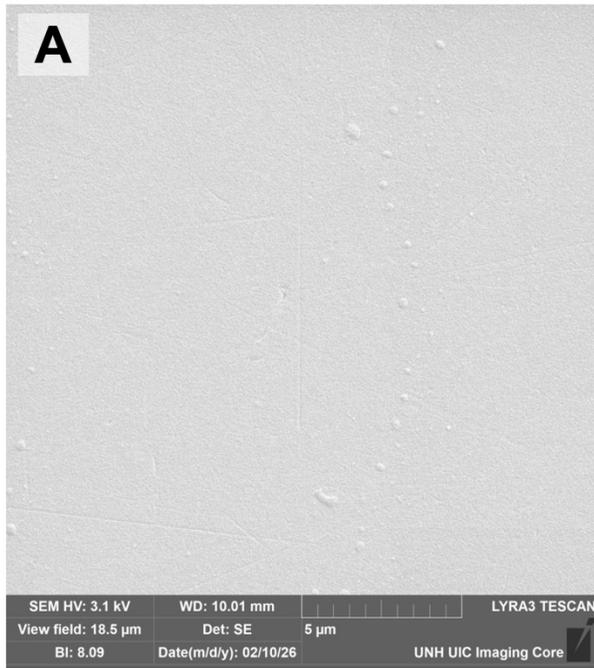


Figure S2. FT-IR spectra of osmium complex  $\text{Os}(\text{bpy})_2\text{Cl}_2$ , unmodified polymer  $\text{Poly}(\text{NIPAM-MAA-VP})$ , and modified polymer  $\text{Poly}(\text{NIPAM-MAA-VP})\text{-g-Os}(\text{bpy})_2\text{Cl}$ .

Fourier-transform infrared (FTIR) spectroscopy was performed to further verify the successful synthesis of  $\text{poly}(\text{NIPAM-VP-MAA})$ ,  $\text{Os}(\text{bpy})_2\text{Cl}_2$ , and the grafting of  $\text{Os}(\text{bpy})_2\text{Cl}_2$  onto the polymer backbone to yield  $\text{poly}(\text{NIPAM-VP-MAA})\text{-g-Os}(\text{bpy})_2\text{Cl}$  (Figure S2). In the  $\text{poly}(\text{NIPAM-VP-MAA})$  spectrum, a series of peaks near  $1400\text{ cm}^{-1}$  corresponds to the aromatic rings of vinylpyridine. Characteristic C=O stretching bands appear at  $1560\text{ cm}^{-1}$  for PNIPAM and  $1720\text{ cm}^{-1}$  for PMAA. For the  $\text{Os}(\text{bpy})_2\text{Cl}_2$  complex, a distinct pyridine-associated band ( $-\text{C}=\text{N}-\text{C}-$ ) is observed at  $3400\text{ cm}^{-1}$ .

In both the unmodified and the modified polymers spectra, aliphatic C-H stretching peaks are visible at  $2850\text{--}2950\text{ cm}^{-1}$ , confirming the presence of polymer chains in  $\text{poly}(\text{NIPAM-VP-MAA})\text{-g-Os}(\text{bpy})_2\text{Cl}$ . Carbonyl-related peaks of PNIPAM and PMAA also appear in between  $1500\text{--}1700\text{ cm}^{-1}$  range. Importantly, in the  $\text{poly}(\text{NIPAM-VP-MAA})\text{-g-Os}(\text{bpy})_2\text{Cl}$  spectrum, a new band emerges around  $750\text{ cm}^{-1}$ , attributed to C-C vibrations within the pyridine ring. These spectral features confirm that the  $\text{Os}(\text{bpy})_2\text{Cl}_2$  complex was successfully grafted to the PVP segments of the polymer backbone.

## 3. SEM Imaging



*Figure S3. The scanning electron microscopy (SEM) images of (A) bare gold electrode; and (B) polymer-deposited gold electrode.*