

Electrochemical hydrophilicity switching of tricationic polymer synthesized by atom transfer radical polymerization (ATRP) method

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Temperature-responsive polymers such as poly(*N*-isopropyl acrylamide) (PNIPAM) can change their hydrophilicity in response to temperature and are used for cell-sheet engineering, using the ability of altering the biomolecular adhesiveness.¹ However, the local control of the hydrophilicity has been challenging in the conventional cell sheets responsive to the incubation temperature. In this study, we aimed to solve this problem by fabricating a substrate covered with polymer brush whose hydrophilicity can be electrochemically controlled.

First, poly(4-vinyl pyridine) (P(4-VP)) was synthesized by atom transfer radical polymerization (ATRP) method. Second, a viologen moiety was introduced into the side chains of P(4-VP) according to scheme shown in Figure 1, and a random copolymer, poly(4-vinyl pyridine-*ran*-*N*-1-ethyl-4-vinylpyridinyl-*N'*-ethylviologen) (P(VPyr-Vio)) was synthesized. The structure of the resulting polymer was evaluated by ¹H-NMR, and the electrochemical response was measured using electrochemical quartz crystal microbalance (EQCM) method in aqueous solution. The EQCM measurement shows that the polymer precipitated at the reduction step and dissolved at the oxidation step, which was observed as the reversible increase and decrease of the electrode mass (Figure 2). This result suggests that the hydrophilicity of P(VPyr-Vio) can be controlled by the electrochemical redox reaction, which is a desired polymer function for the electrochemical cell-sheet engineering.

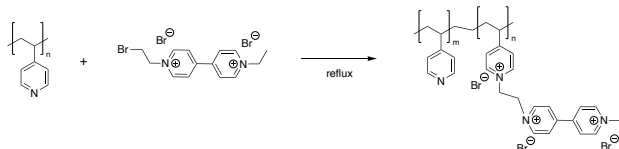


Fig.1 Synthesis scheme of P(VPyr-Vio)

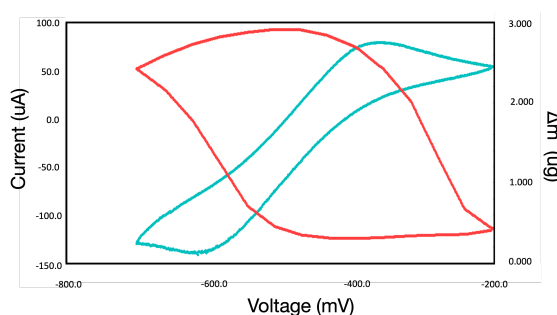


Fig.2 EQCM measurement of P(VPyr-Vio) in aqueous solution (red: QCM, blue: CV)

1) M. Sponchioni, U. Capasso Palmiero, D. Moscatelli, *Mater. Sci. Eng. C* 102 **2019** 589–605