

Electronic Supplementary Information

A Novel Red to Transmissive Electrochromic Polymer Based on Phenanthrocarbazole

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FT-IR: The monomer solution (CHCl_3) was drop casted on ITO glass and the ATR-FTIR was recorded (Figure 1). The polymer was electrochemically coated as described in the paper and ATR-FTIR was recorded (Figure 2).

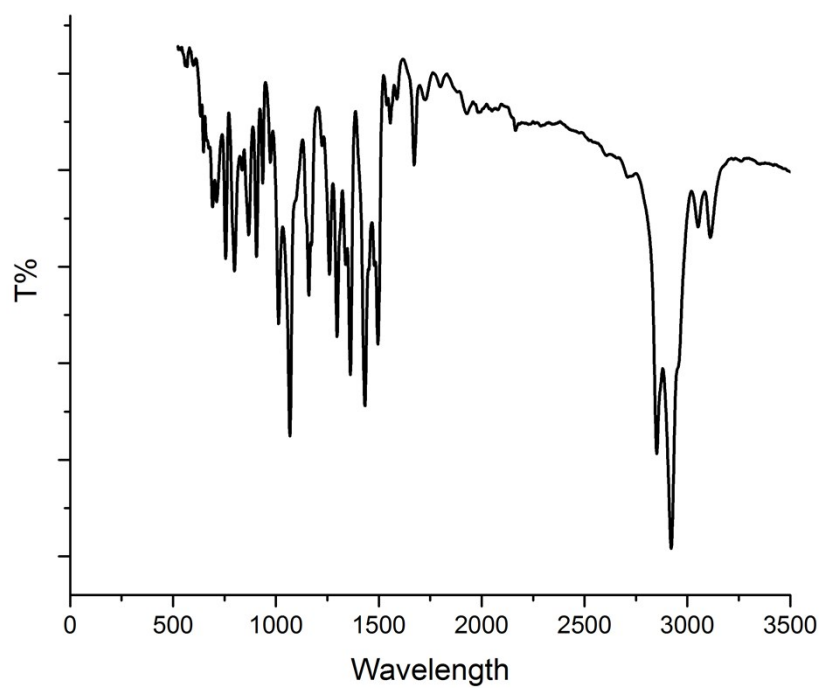


Figure S11. ATR-FTIR of **DEP**.

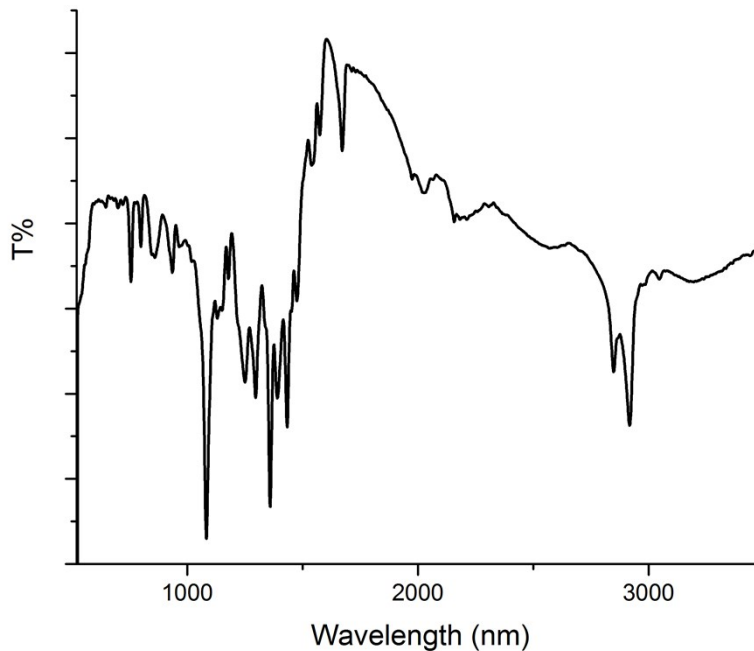


Figure S12. ATR-FTIR of the **PDEP**.

As can be seen from the spectra, C-H stretching of the EDOT units in the monomer ($3020\text{-}3170\text{ cm}^{-1}$) almost completely disappeared as the polymer film formed on the surface. The expected peaks, C-N stretching ($1080\text{-}1360\text{ cm}^{-1}$), C-O stretching ($1000\text{-}1300\text{ cm}^{-1}$), Aromatic C-H stretching ($\sim 2950\text{ cm}^{-1}$), aliphatic C-H stretching ($\sim 2850\text{ cm}^{-1}$) are clearly observed in the IR spectrum of the polymer.

SEM: Scanning electron microscopy analyses showed the polymer film formed on ITO surface uniformly (Figure S13). Closer images (Figure S13) clearly show cauliflower like forms, which are the common type of structures that are observed for conjugated polymer films.

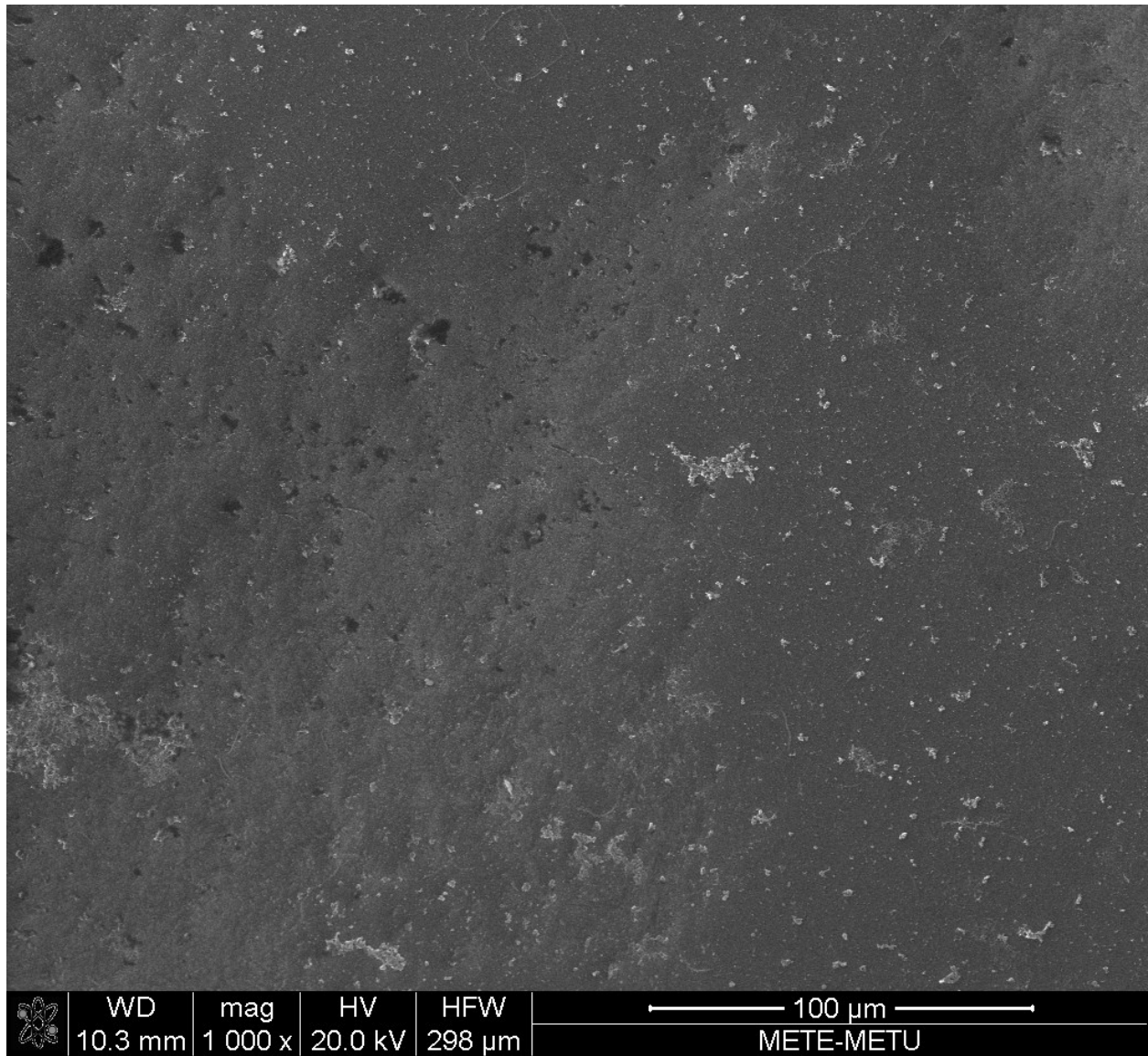


Figure S13. SEM images of **PDEP** at 1000x magnification.

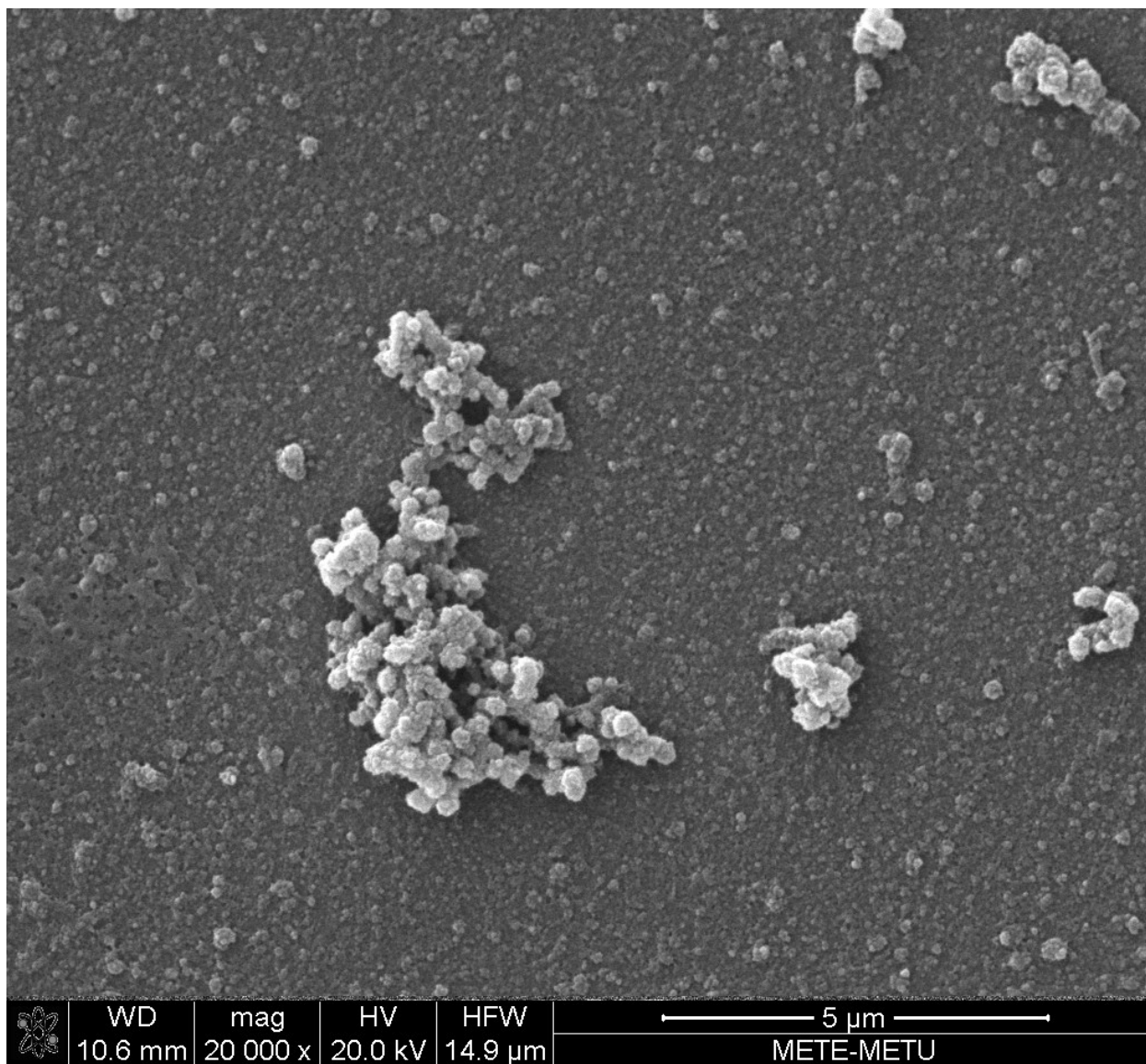


Figure S14. SEM images of **PDEP** at 20000x magnification.

AFM: AFM images also show the formation of a smooth film on ITO surface (Figure SI5). A roughness of 16 nm was determined over a large area (Figure SI6).

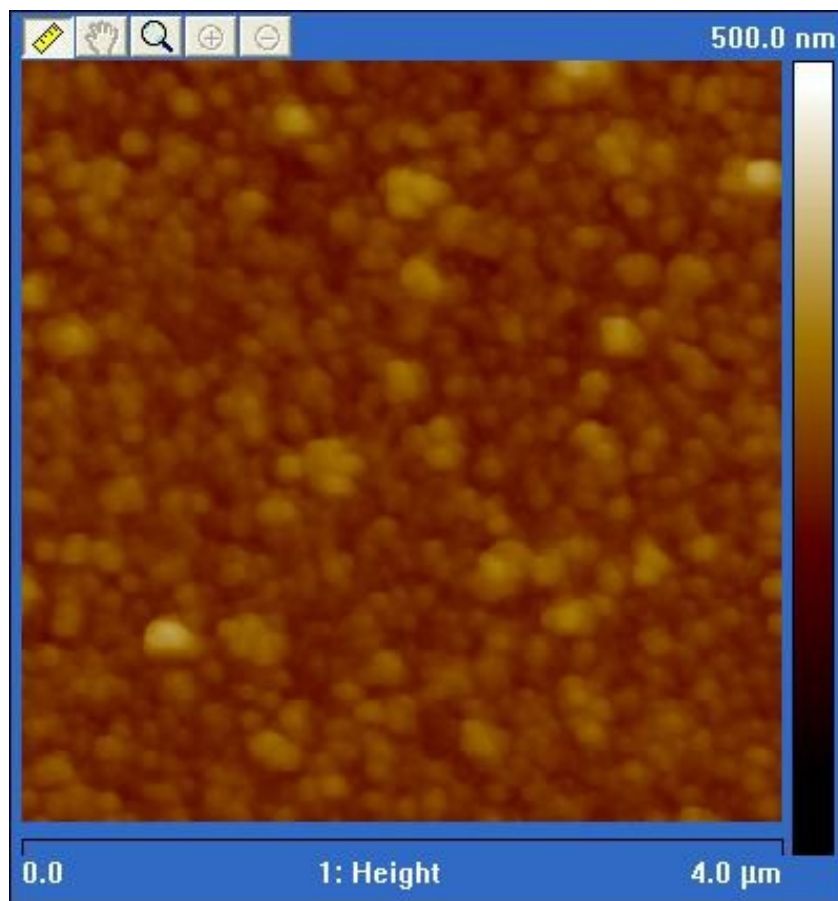


Figure SI5. AFM image of **PDEP** (4 μm x 4 μm).

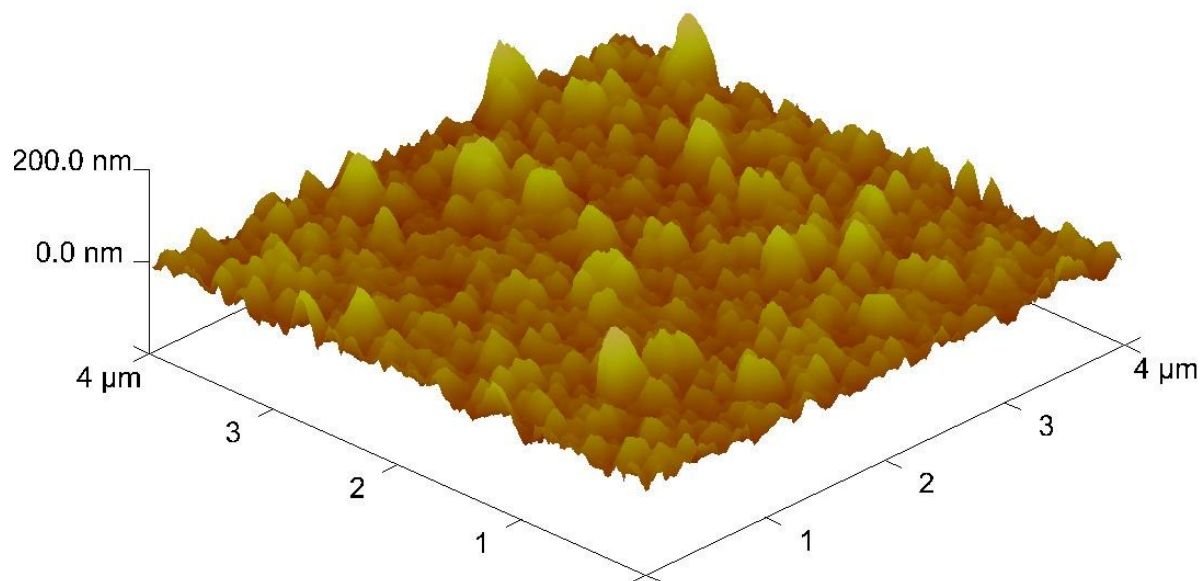


Figure SI6. Roughness analysis of **PDEP** ($4\ \mu\text{m} \times 4\ \mu\text{m} \times 200\ \text{nm}$).

The film thickness was determined from 3 different points that averaged to a thickness of 147 nm (Figure SI7).

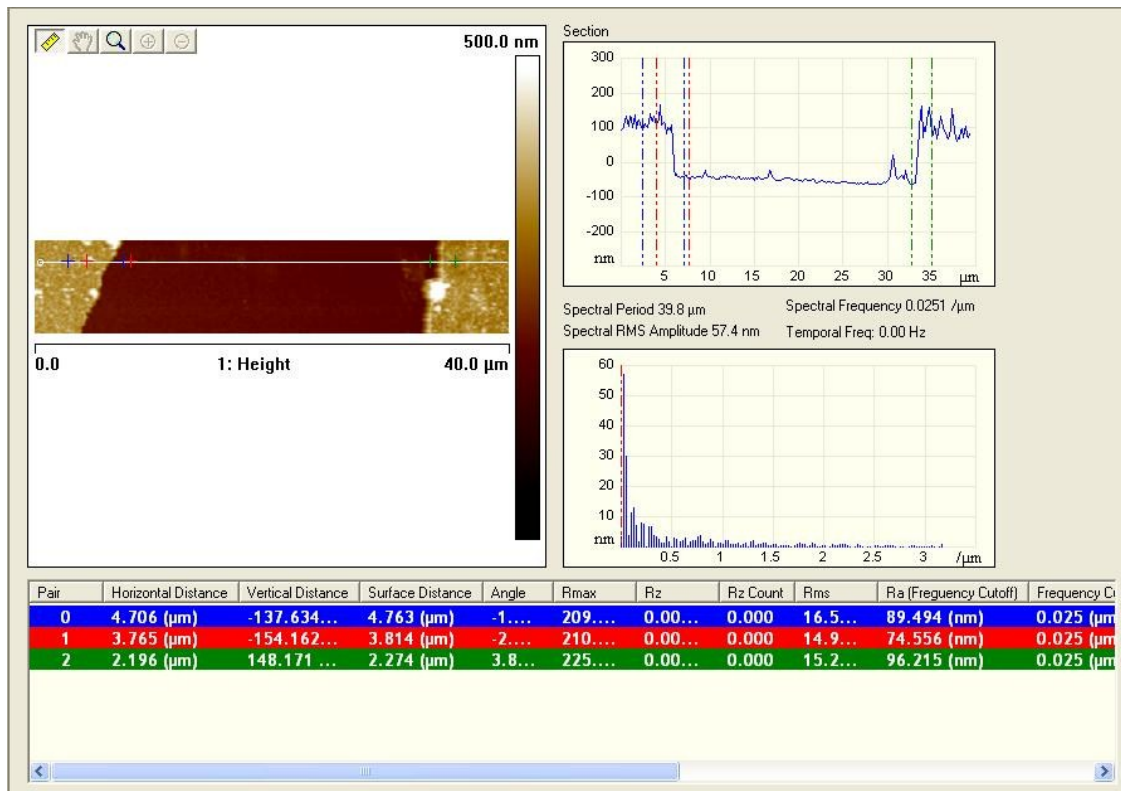


Figure S17. Film thickness analysis of PDEP.