Supporting Information

Figure S1. SEM and TEM images of PPY film (a) and Au-HTPC seeds (b)

Figure S2. The cross-sectional SEM image of NPG film
Figure S3 Nitrogen sorption isotherms of thin NPG film

\( \text{N}_2 \) sorption isotherms (Figure S3) of NPG film show pseudo-type-I curve with H1 hysteresis loop at a high relative pressure. The hysteresis loop at a higher \( p/p_0 \) (0.92-0.987) may be contributed by the inter-particle texture and nanoporous characterization.

Figure S4. NPG films fabricated on different substrates (a) ITO glass, (b) universal glass
Figure S5. Raman spectra of PPY and NPG/PPY on the inwall of PPCT

Figure S6 Image of PPCT (1.5 ml)

The calculation of inwall area of PPCT

The inwall area of circular cone \( S_1 \) of PPCT

\[
S_1 = \pi r_2 l_2 = 3.14 \times 0.45 \text{ cm} \times 2 \text{ cm} = 2.82 \text{ cm}^2
\]

The inwall area of circular column \( S_2 \) of the PPCT

\[
S_2 = 2\pi r_1 l_1 = 2 \times 3.14 \times 0.45 \text{ cm} \times 0.8 \text{ cm} = 2.26 \text{ cm}^2
\]

\[
S_{\text{total}} = S_1 + S_2 = 5.08 \text{ cm}^2
\]