Electronic Supplementary Information

Triptycene-Based Two-dimensional Porous Organic Polymeric Nanosheet

Jing-Jing Chen, ‡ [a] Tian-Long Zhai, ‡ [a] Yi-Fan Chen, [b] Shinan Geng,[a] Chan Yu,[a] Jun-Min Liu,*[b] Linling Wang,*[c] Bien Tan,*[d] and Chun Zhang*[a]

‡ J.-J. Chen and T.-L. Zhai contributed equally to this work.

Contents

1. General Information

Materials obtained commercially were used without further purification.

2. Characterizations of 2D-PTNS

2.1 Electron Microscopy

Transmission electron microscopy (TEM) analysis was carried out by Tecani G220 at 200 kV. The samples were prepared by dispersing the product in Methanol with assistance of ultrasonication, followed by dropping the dispersion onto carbon coated copper grids and drying at ambient temperature. Atomic force microscopy (AFM) analysis was carried out by SPM 9700. The samples were prepared by the similar method with TEM, dropping the dispersion onto the mica and drying at ambient temperature.

2.2 IR and Raman Spectroscopy

FT-IR spectra were recorded by VERTEX 70 micro FT-IR spectroscopy. The Raman spectra were obtained by Raman Imaging Microscope System (LabRAM HR800), with excitation laser wavelength at 632.8 nm.

2.3 Thermal Properties Characterization

Thermogravimetric analysis (TGA) analysis was conducted by Pyris1 TGA with heatingrate of 10 °C min^{-1} in nitrogen atomosphere.

2.4 Nitrogen Adsorption Measurement

Nitrogen adsorption experiments were performed with ASAP 2020 (Micromeritics, USA) at 77 K. The sample was outgassed at 110 °C for 15 hours under vacuum before measurement.

2.5 Gas Adsorption Measurement

Carbon dioxide, methane and ethane adsorption experiments were performed with ASAP 2020 (Micromeritics, USA) at 273 K and 298 K. The sample was outgassed at 110 °C for 15 hours under vacuum before measurement.

2.6 *In situ* Raman spectroscopy

For the in situ Raman kinetic experiments, the reaction spectra were recorded using an OPAL-3000 Raman spectrometer from Enwave Optronics, Inc., USA. Data collection was carried out using the Raman Application Center software (Ver. 8.1.3, Enwave Optronics, Inc., USA.), and the collected data was imported to and manipulated by OPUS software (Ver. 7.0.129, Bruker Optik GmbH, Germany).

3. TGA plots of of the 2D-PTNS.

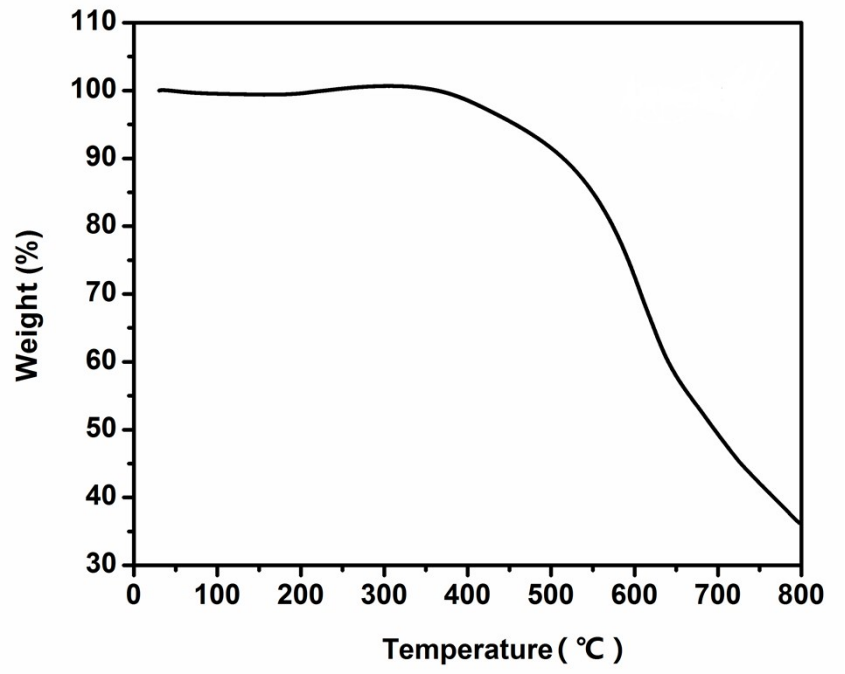

Fig. S1. The TGA plots of the **2D-PTNS.**

4. PXRD spectroscopy of the 2D-PTNS.

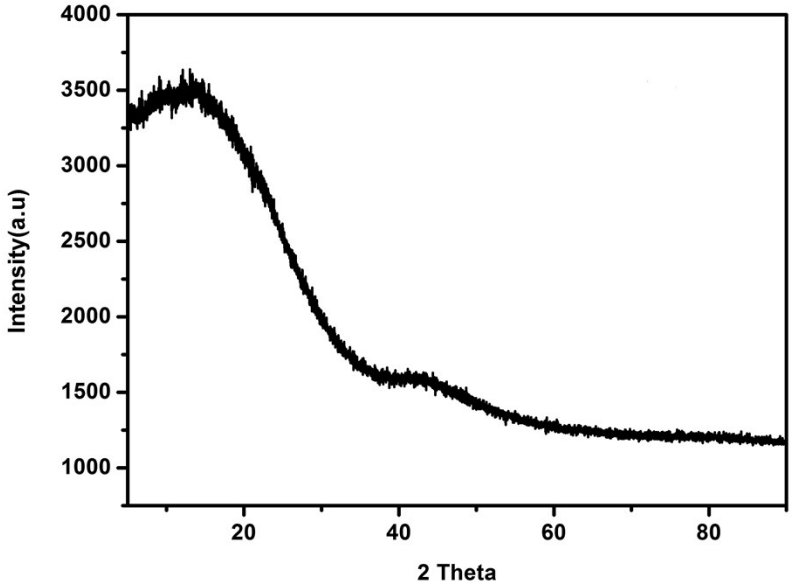

Fig. S2. The PXRD spectroscopy of the **2D-PTNS**.

5. Photos of reaction processes of 2D-PTNS

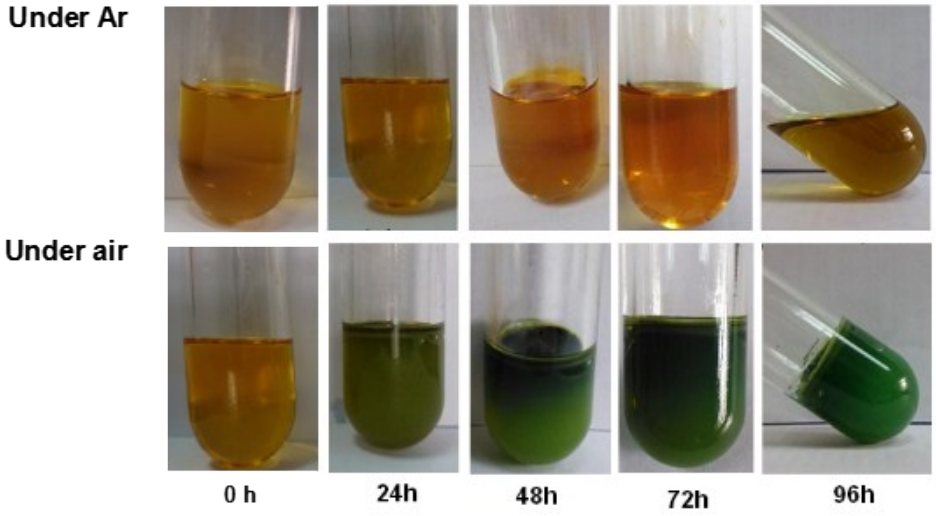

Fig. S3. The photos of reaction processes of **2D-PTNS** under argon (top) or air (bottom) atmosphere.

6. *In situ* FT-Raman spectra of the 2D-PTNS

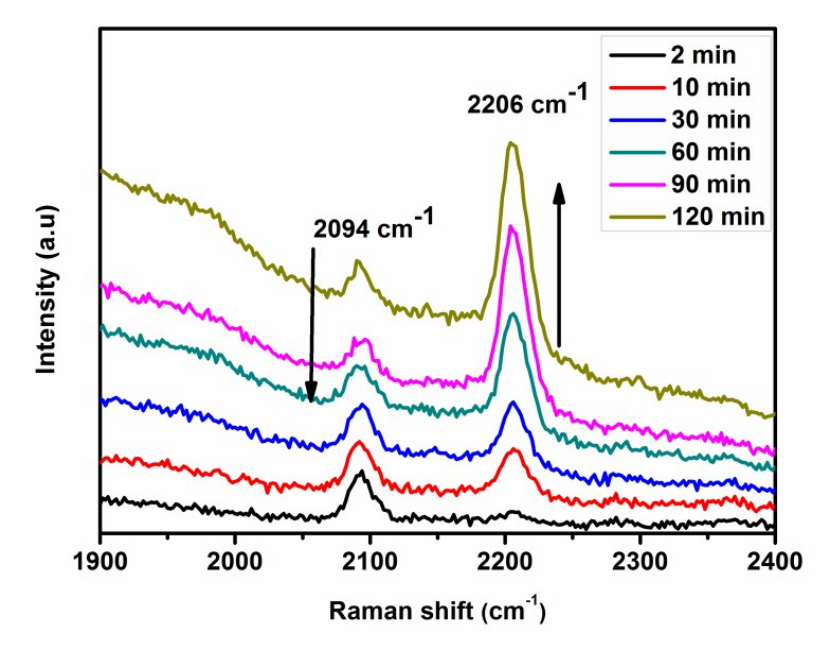

Fig. S4. The *in situ* FT-Raman spectra of the **2D-PTNS**.

7. BET surface area plot for 2D-PTNS.

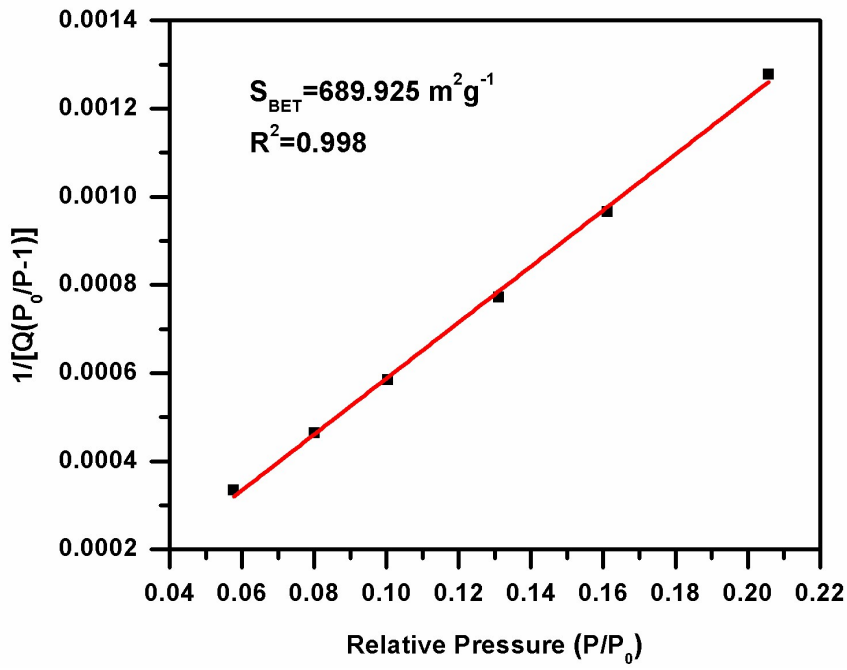

Fig. S5. The Brunauer-Emmett-Teller (BET) surface area of the **2D-PTNS**.

8. The H_2 isotherms of 2D-PTNS.

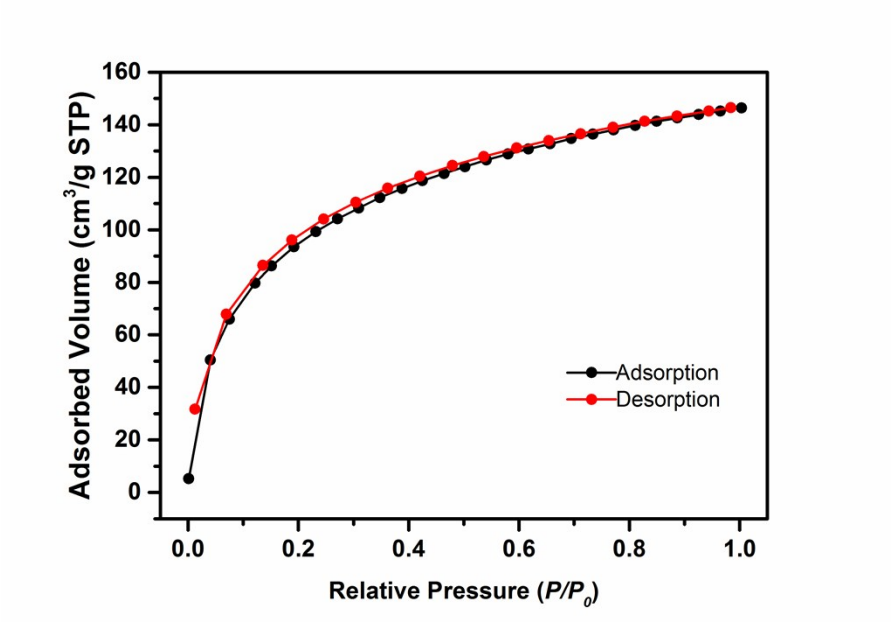

Fig. S6. The H_2 isotherm of **2D-PTNS** measured at 77 K.

9. The Q_{st} of the 2D-PTNS

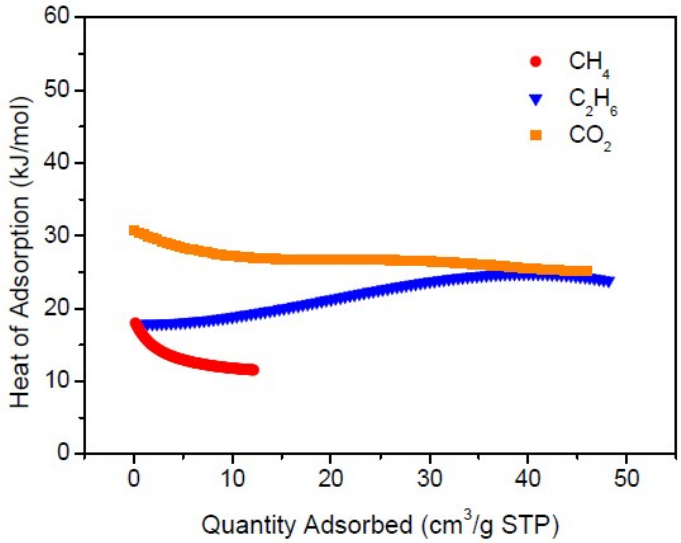

Fig. S7. The heat of adsorption (Q_{st}) of CO_2 (orange), C_2H_6 (blue) and CH_4 (red) of the **2D-PTNS.**

10. Initial gas uptake slopes for CO_2 and N_2 of the 2D-PTNS

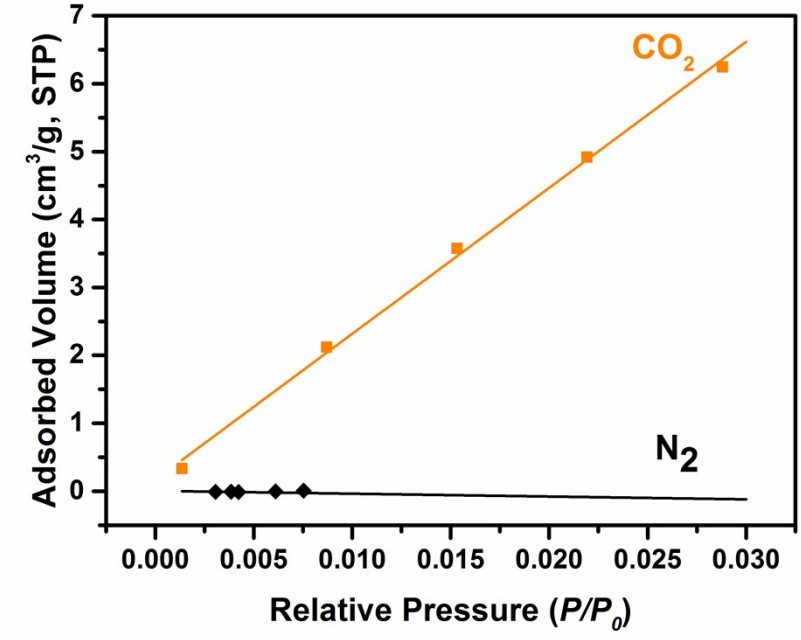

Fig. S8. The Initial gas uptake slopes for CO_2 (orange) and N_2 (black) of the **2D-PTNS** at 273K.

11. Initial gas uptake slopes for CO_2 and CH_4 of the 2D-PTNS

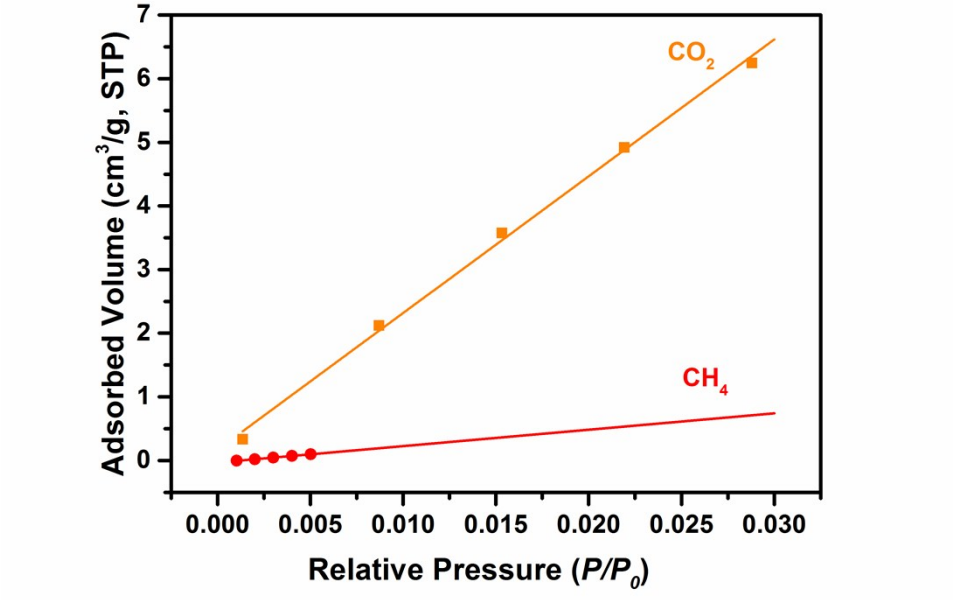

Fig. S9. The Initial gas uptake slopes for CO_2 (orange) and CH_4 (red) of the **2D-PTNS** at 273K.

12. Initial gas uptake slopes for C_2H_6 and CH_4 of the 2D-PTNS (273K)

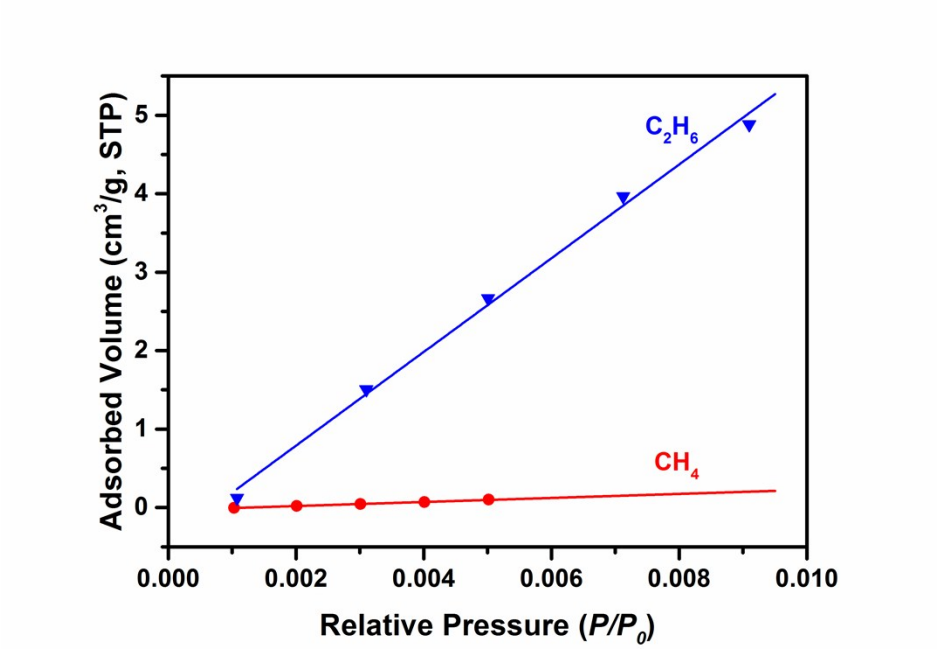

Fig. S10. The Initial gas uptake slopes for C_2H_6 (blue) and CH_4 (red) of the **2D-PTNS** at 273K.

13. Initial gas uptake slopes for C_2H_6 and CH_4 of the 2D-PTNS (298K)

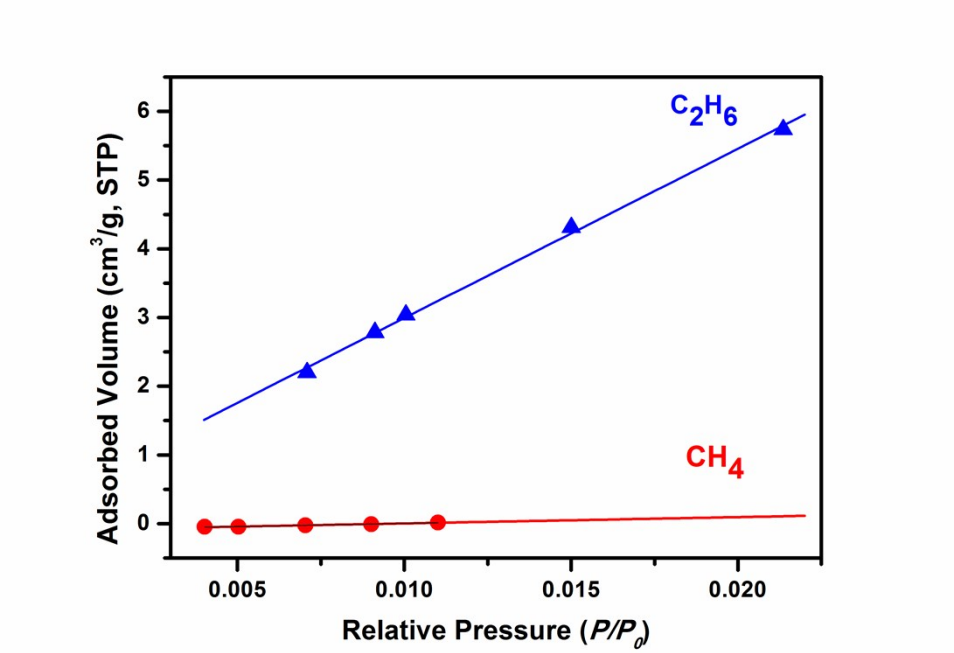

Fig. S11. The Initial gas uptake slopes for C_2H_6 (blue) and CH_4 (red) of the **2D-PTNS** at 298K.