Supplementary Material

Tailoring novel Polymer/UTSA-16 hybrid aerogels for efficient CH_4/CO_2 separation

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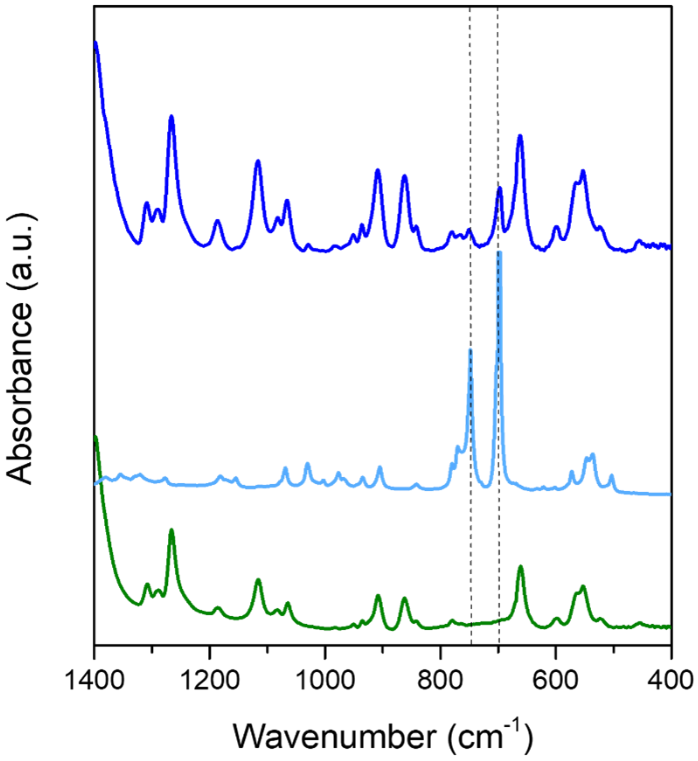

Fig. S1 - IR spectra of UTSA-16 (green), sPS aerogel (light blue) and sPS/UTSA-16 aerogels (blue).

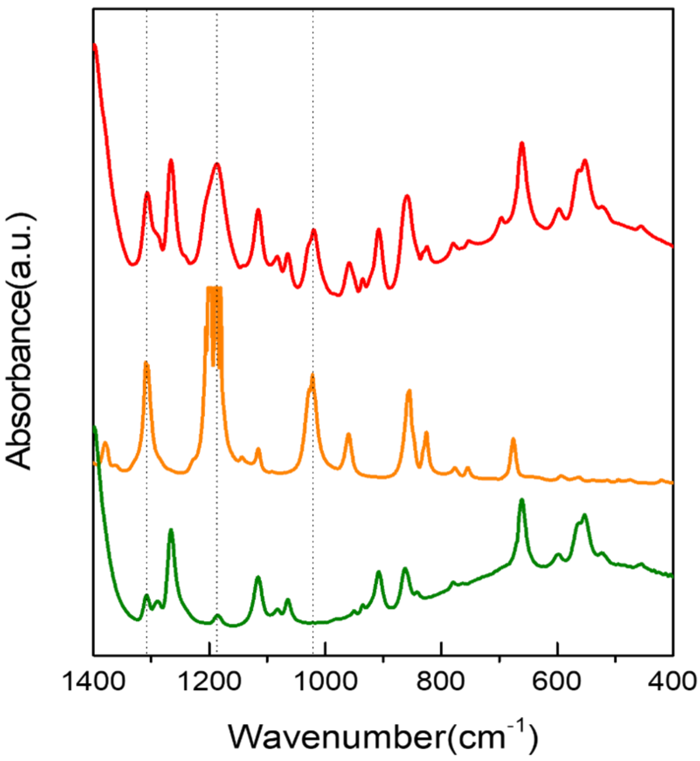

Fig. S2 - IR spectra of UTSA-16 (green), PPO aerogel (orange) and PPO/UTSA-16 aerogels (red)

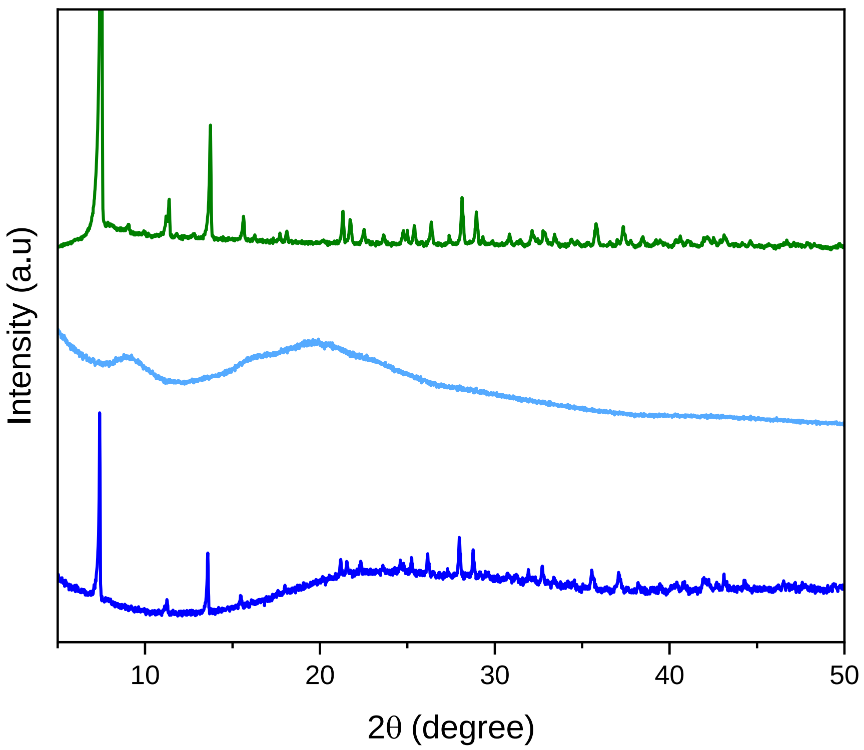

Fig. S3 – XRD patterns of UTSA-16 (green), sPS aerogel (light blue) and sPS/UTSA-16 aerogels (blue).

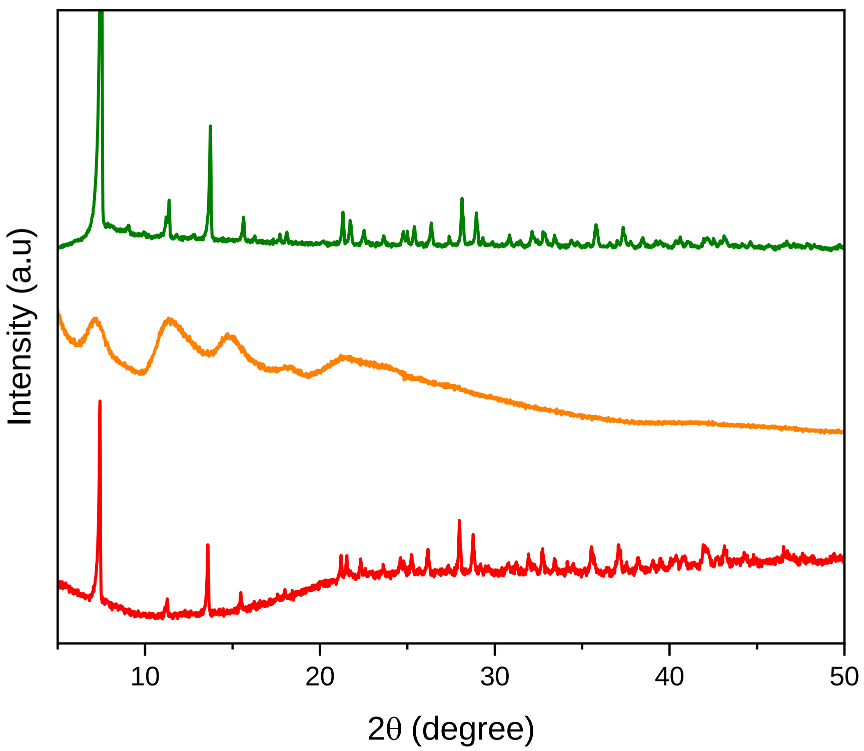

Fig. S4 - XRD patterns of UTSA-16 (green), PPO aerogel (orange) and PPO/UTSA-16 aerogels (red)

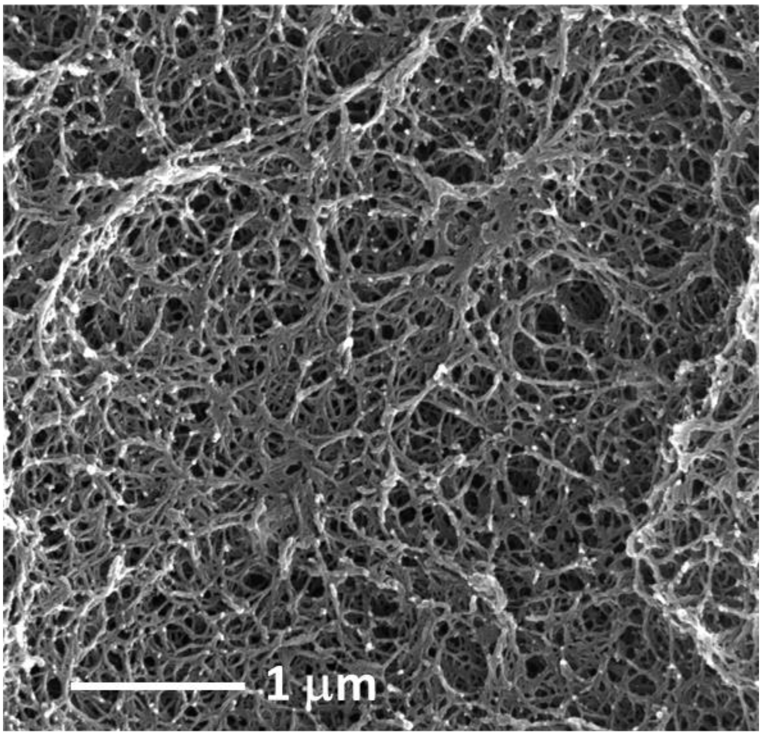

Fig. S5 - SEM image of a composite s-PS/UTSA-16 aerogel with a 1/7 polymer/MOF ratio.

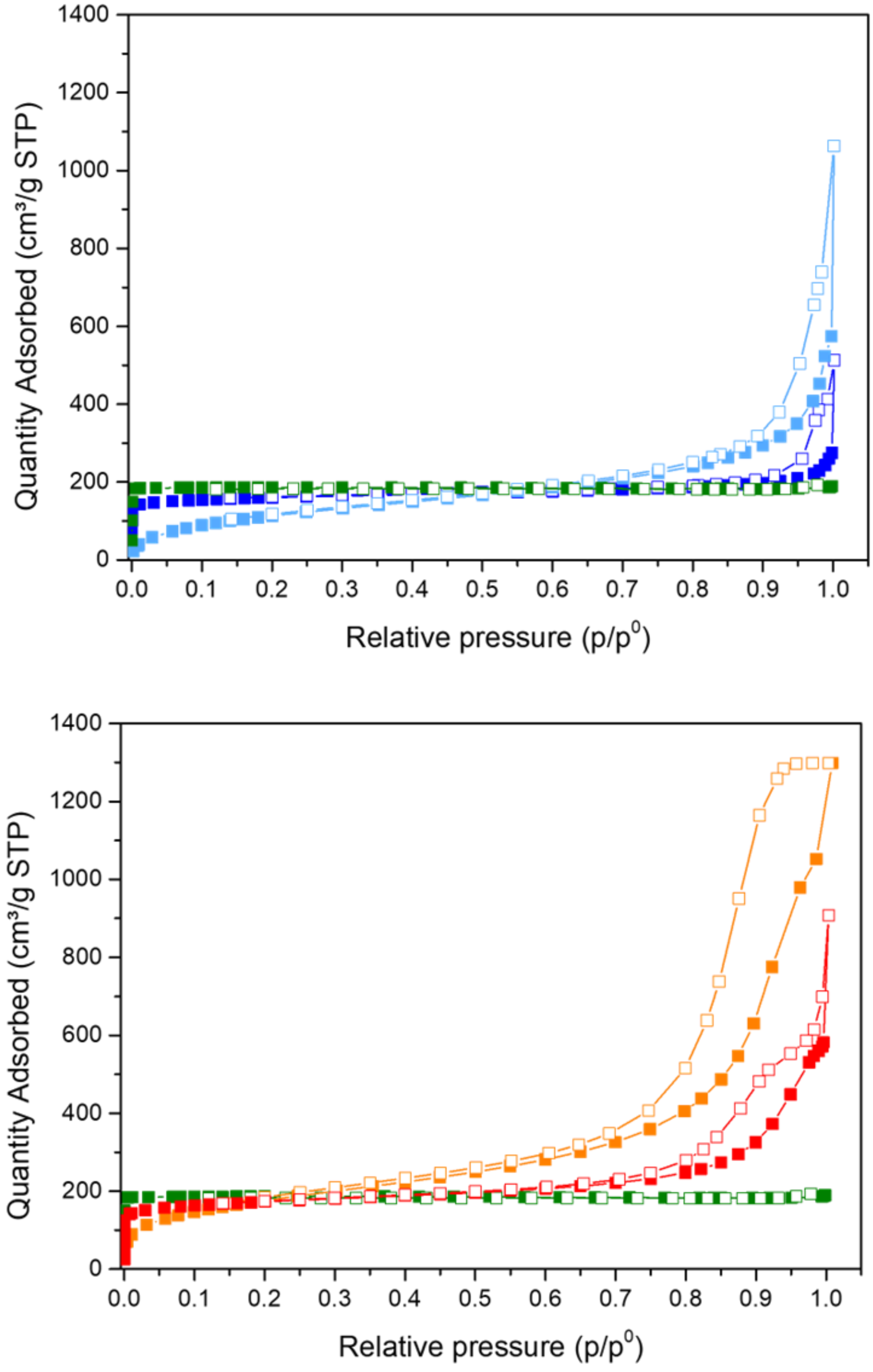

Fig.S6 - N_2 adsorption isotherms at 77 K. Full symbols refer to the adsorption isotherm; empty symbols refer to the desorption isotherm. Colour-code: Green for UTSA-16 powder; Light blue for sPS; Blue for sPS/UTSA-16; Orange for PPO; Red for PPO/UTSA-16.

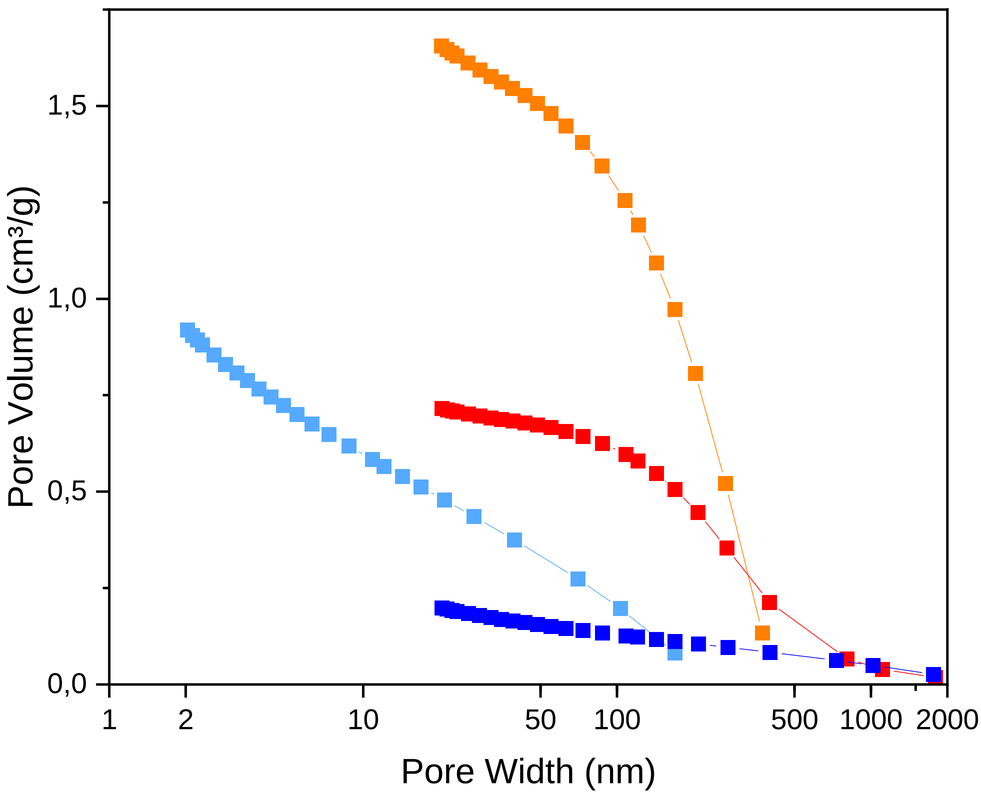

Fig.S7 – Total pore volume (cm^3/g) obtained by applying BJH adsorption model. Colour-code: Light blue for sPS; Blue for sPS/UTSA-16; Orange for PPO; Red for PPO/UTSA-16.

Table.S1 – Textural properties derived from N_2 isotherms at 77 K normalized to the density.

	BET SSA (m^2/cm^3)	Langmuir SSA (m^2/cm^3)	Micropore area[a] (m^2/cm^3)	Micropore volume[a] (cm^3/cm^3)	Mesopore volume[b] (cm^3/cm^3)
sPS (0.12 g/cm^3)	52.8	74.8	10.8	0.004	0.110
PPO (0.11 g/cm^3)	71.1	98.9	11.6	0.004	0.182
UTSA-16 (1.659 g/cm^3)	1025.3	1350.4	1030.2	0.465	\
sPS/UTSA-16 (0.3 g/cm^3)	162.6	214.5	157.2	0.072	0.06
PPO/UTSA-16 (0.2 g/cm^3)	118	157	83.4	0.038	0.144

[a] Calculated from t-plot; [b] Calculated by BJH adsorption model.

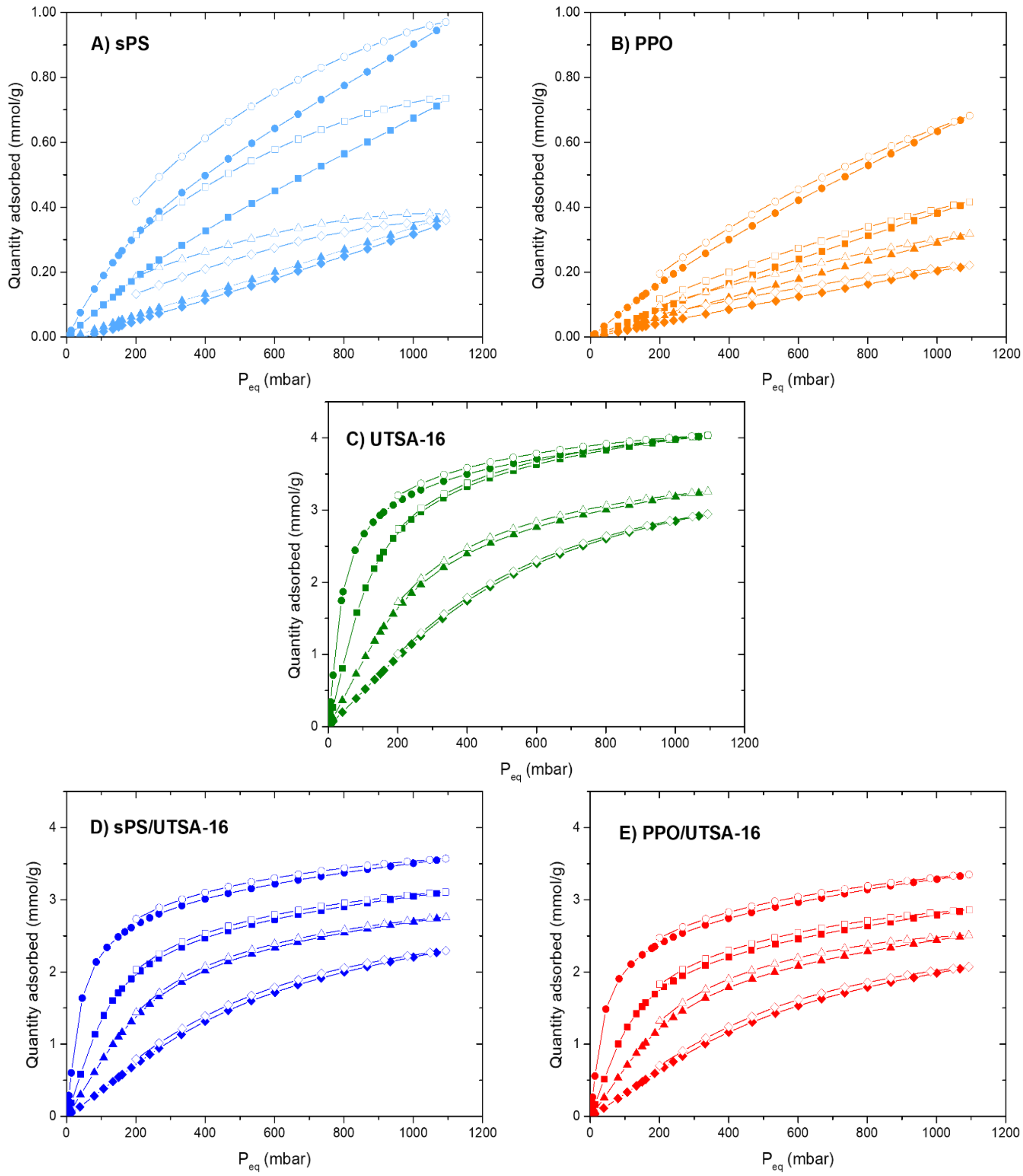

Fig.S8 - CO_2 adsorption isotherms at different temperatures: ● 273K; ■ 298K; ▲ 313K; ◆ 333K. Full symbols refer to the adsorption isotherm; empty symbols refer to the desorption isotherm.

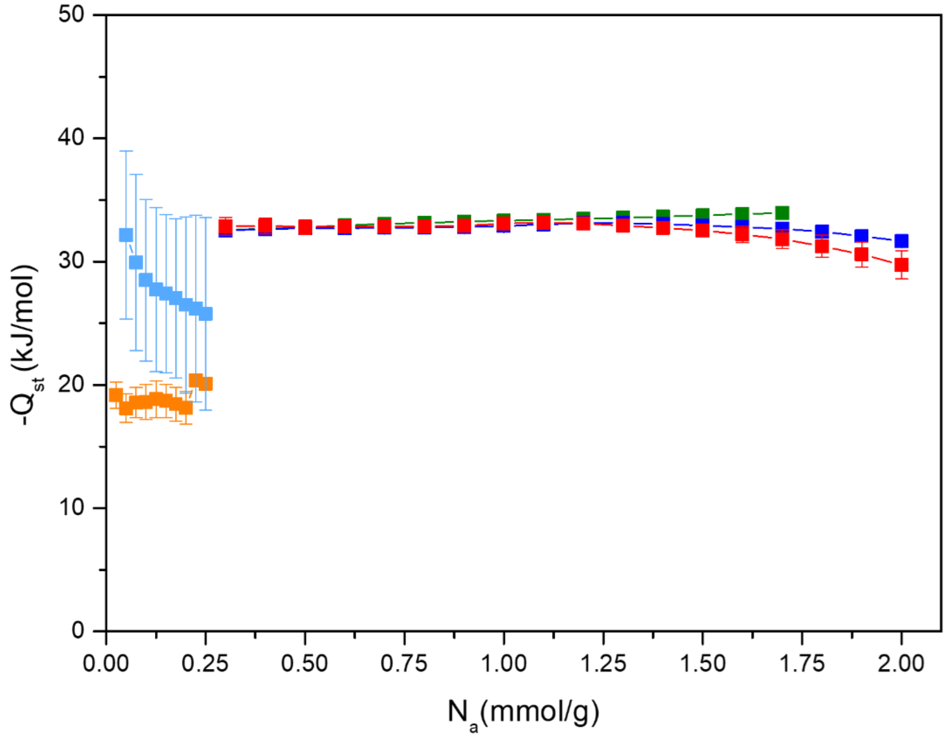

Fig.S9 - Isosteric heat of adsorption (-Qst) of CO_2 computed applying the Clausius-Clapeyron approximation by fitting the adsorption isotherms at 273, 298, 313 and 333 K. Colour-code: Green for UTSA-16 powder; Light blue for sPS; Blue for sPS/UTSA-16; Orange for PPO; Red for PPO/UTSA-16.

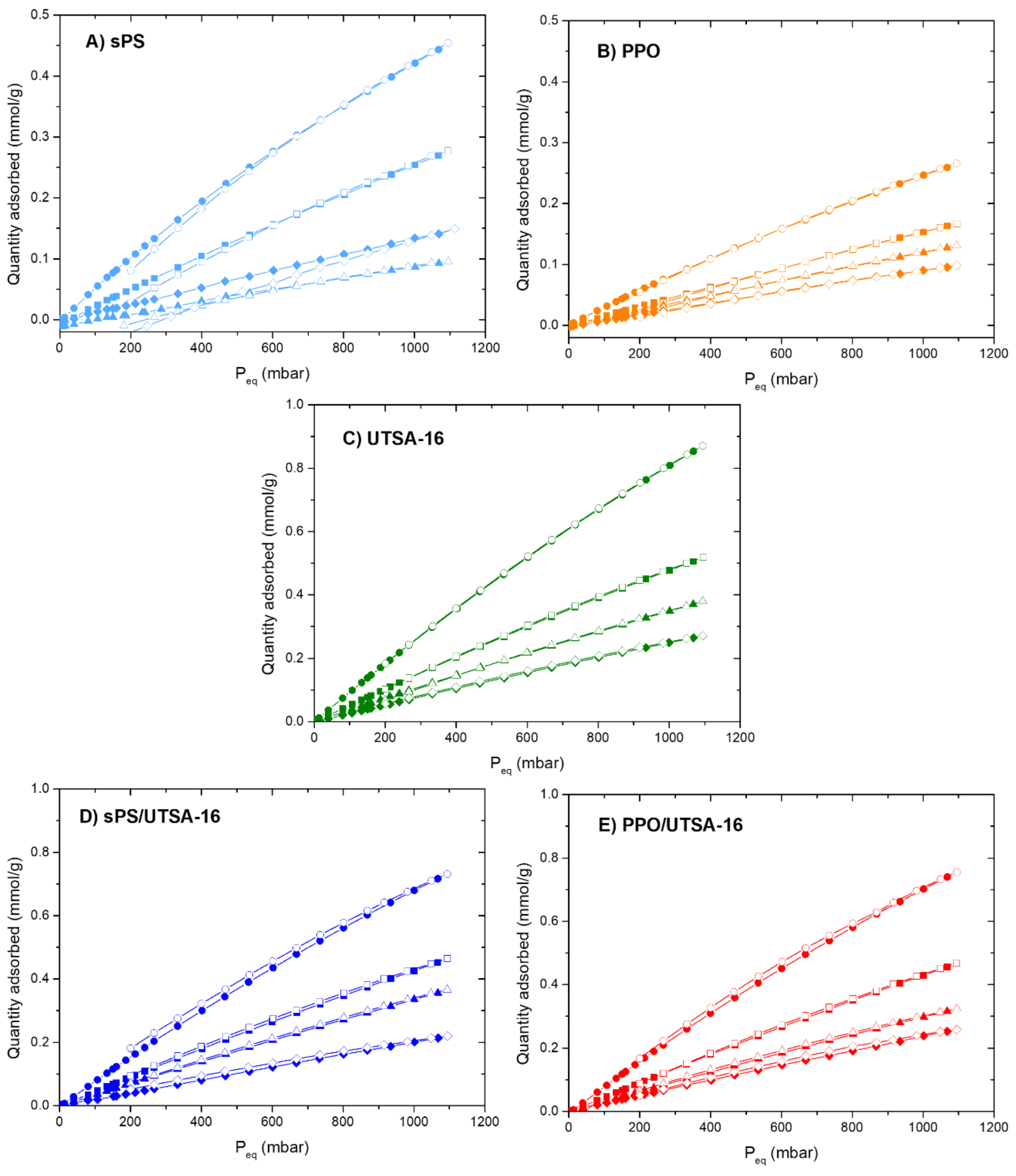

Fig.S10 - CH_4 adsorption isotherms of all samples at different temperatures: ● 273K; ■ 298K; ▲ 313K; ◆ 333K.

Full symbols refer to the adsorption isotherm; empty symbols refer to the desorption isotherm.

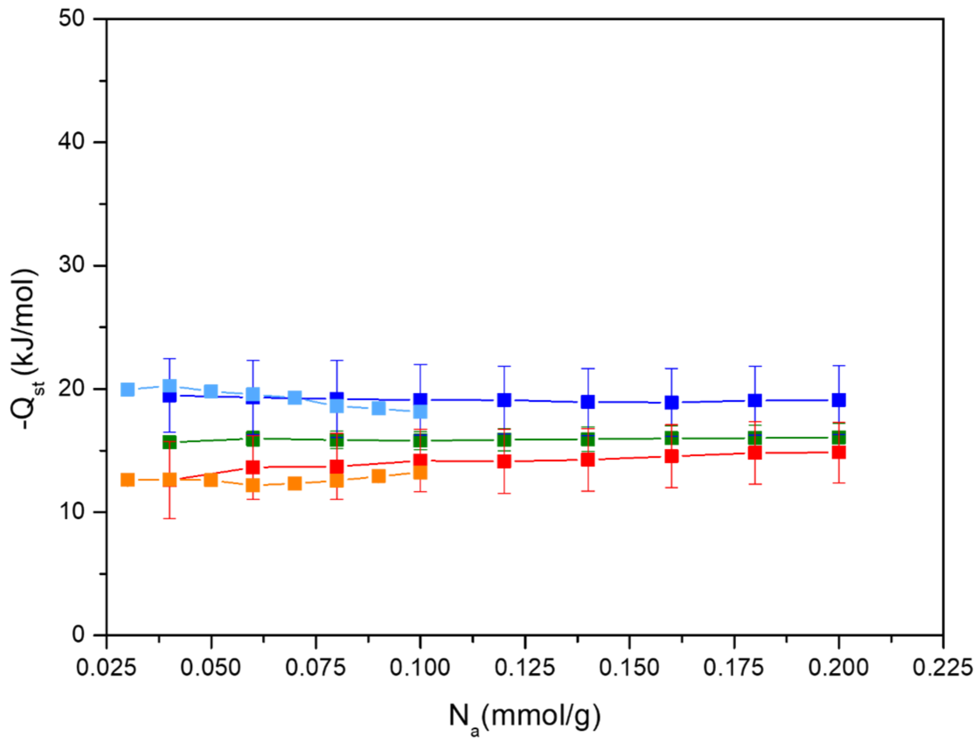

Fig.S11 - Isosteric heats of adsorption (-Qst) of CH_4 computed applying the Clausius-Clapeyron approximation by fitting the adsorption isotherms at 273, 298, 313 and 333 K. Colour-code: Green for UTSA-16 powder; Light blue for sPS; Blue for sPS/UTSA-16.

Table.S2 - Uptake capacity of CO_2 at 298 K and 1 bar normalized to the density of the materials.

CO_2	**sPS**	**PPO**	**UTSA-16**	**sPS/UTSA-16**	**PPO/UTSA-16**
Uptake capacity (mmol/cm^3)	0.082	0.043	6.545	0.915	0.56
Uptake capacity (% respect UTSA-16)	1.25	0.67	100	13.98	8.55

CO_2	**sPS**	**PPO**	**UTSA-16**	**sPS/UTSA-16**	**PPO/UTSA-16**
Uptake capacity (mmol g^{-1})	0.68	0.39	3.98	3.05	2.80
Uptake capacity (% respect UTSA-16)	17.08	9.80	100	76.63	70.35

Table.S3 - Uptake capacity of CH_4 at 298 K and 1 bar normalized to the density of the materials.

CH_4	**sPS**	**PPO**	**UTSA-16**	**sPS/UTSA-16**	**PPO/UTSA-16**
Uptake capacity (mmol/cm^3)	0.03	0.017	0.81	0.123	0.082
Uptake capacity (% respect UTSA-16)	3.7	2.1	100	15.2	10.1

CH_4	**sPS**	**PPO**	**UTSA-16**	**sPS/UTSA-16**	**PPO/UTSA-16**
Uptake capacity (mmol g^{-1})	0.25	0.15	0.49	0.41	0.41
Uptake capacity (% respect UTSA-16)	51.02	30.61	100	83.7	83.7