Polymer of Intrinsic Microporosity (PIM-1)

- Bright yellow powder is soluble in polar aprotic solvents (e.g. chloroform, THF).
- Initially synthesised using the optimised method of Song et al. [5], although this resulted in a material that formed brittle, cracked films ($M_\text{r} = 9765 \text{ g mol}^{-1}$, PDI = 2.66).
- Synthesis using the original method of Budd et al. [6] resulted in a better quality PIM ($M_\text{r} = 76261 \text{ g mol}^{-1}$, PDI = 2.53).
- TGA under N$_2$ flow determines thermal stability up to $\sim 430 \degree C$.
- Helium pycnometry gives skeletal density of 1.24 g cm$^{-3}$.
- Rouquerol BET surface area = 621.2 $\pm$ 3.0 m$^2$ g$^{-1}$ (N$_2$ isotherm at 77 K).
- Pore size distribution reveals more than half the pore volume is microporous (HK total pore volume = 0.463 cm$^3$ g$^{-1}$).

Future Work

- Synthesis of PIM-1/MOF-5 composite (in progress).
- Continued analysis of adsorbent properties of materials, including fitting to a model developed at the University of Bath to determine parameters such as adsorbate density and pore volume.
- Analysis of mechanical (tensile and flexural moduli), thermal (specific heat capacity, thermal conductivity) and binding properties of materials.
- Develop ‘rule of mixtures’-style correlations between composite content and properties.
- Design of hybrid hydrogen storage tank with a composite liner.