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Synthesis of light and robust porous organic frameworks as reusable adsorbents

Jianwei Guo
Guangdong University of Technology, China

Using (bi) adamantane "knots" and p-phenylene "rods" as building blocks, porous organic polymers (POP) were synthesized by Suzuki coupling polycondensation with high yields, i.e. 85-94%. The saturation of the polymer linking knot and rod groups was determined by FT-IR and 13C NMR spectroscopy. The POP material particles were light in weight (volumetric density of 0.1-0.24 g cm-3), porous, and spherical in shape. The obtained POP materials were highly stable in its structural integrity, demonstrating both exceptional thermal stability upon heating at high temperatures and excellent chemical resistance to strong acid and base. The CH4 and CO2 adsorption capacity of the obtained POPs at 273 K and 1 bar are comparable to many well-known porous polymer frameworks. Notably, the total uptake capability of aliphatic (n-hexane) and aromatic (benzene and toluene) organic vapors were maintained by a simple regeneration treatment, i.e. heating samples at 200°C under vacuum. The adsorption results suggest their potential applications for gas storage and toxic organic vapor removal as reusable and thermochemically stable materials.