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Nanoporous Polymeric Materials For CO2 Capture And Separation

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Abstract

Control of carbon dioxide emissions without significant penalties requires effective CO2 scrubbing from point sources, such as fossil fuel burning power plants, cement factories and steel making. Capturing process is the most costly; hence the research is directed to finding solutions to it. Efficient CO2 scrubbing without a significant energy penalty remains an outstanding challenge for fossil fuel-burning industry where aqueous amine solutions are still widely used. Porous materials have long been evaluated for next generation CO2 adsorbents. Porous polymers, robust and inexpensive, show promise as feasible materials for the capture of CO2 from warm exhaust fumes.
Nanoporous polymeric materials show considerable CO2 uptakes and are likely to replace monoethanol amine (MEA) solutions for industrial CO2 capture. We report recently developed nanoporous covalent organic polymers (COPs), which show significant capacities and selectivities for CO2. To name a few, COP-1 shows 5.6 g/g CO2 uptake at 200 bar and 45 °C, COP-2 shows a CO2/H2 selectivity of over 10:1 and COP-33 1.8 g/g at CO2 uptake at 200 bar 50 °C with a CO2/H2 selectivity of 3:1. These results point to an ideal nanoporous structure to be made from a highly porous, inexpensive, physisorptive solid, which is chemically modified with amine functionalities.