Rational increase in CO_2 capture of inexpensive Covalent Organic Polymers (COPs) by permanent amine grafting

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Liquid, solvated amine based carbon capture is the core of all commercial or planned CO_2 capture operations. Solid amine, monolithic adsorbents are highly desired as replacements, though most studies are focused on physical blends of ethylene diamine oligomers with porous media. We report the first direct introduction of ethylene diamines on the walls of highly porous network polymers through simple activation procedures. CO_2 uptake capacities multiply with the nitrogen content, up to an unprecedented four times of the starting porous polymer in dry flue gas conditions. We suspect a concerted coordination mechanism of multiple amines to a CO_2 molecule. CO_2/N_2 selectivities reach above 300, surpassing most porous networks and zeolites. In moist flue gas conditions the CO_2 uptake capacity is even further doubled. Chemical grafting of the amines allow many cycles without any loss in the uptake capacity, a particular requirement in industrial use. The reported procedure can be generalized to all porous media with hydrocarbon framework in order to convert them into effective CO_2 capture adsorbents.