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Editorial Article

How to Design Porous Organic Polymers as Gas Capture?

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Editorial

In recent years, the design and construction of porous organic polymers (POPs) have attracted significant interest from scientists because of their extensive potential applications in the areas of gas storage, separation, heterogeneous catalysis and sensors, etc. [1]. POP materials are often prepared *via* the direct synthesis methodology because this approach has characteristic advantages: a high utilization efficiency of the starting materials and facile formation of micro pores [2]. In this methodology, two important issues should be addressed. One is selecting proper chemical synthesis methods to efficiently link the building blocks together over a broad range. Among various methods, Sonogashira–Hagihara reaction is a typical class of routes and has been well established for the synthesis of POP materials [3] especially conjugated micro porous polymers (CMPs), which combine micro porosity and π-conjugated bond and have a great promise in the range of applications such as light-harvesting, photo catalysis and sensing, except the typical usage in gas storage [4]. Another is the choice of the correct monomers, which are crucial to the formation of porous networks with adequate stability and largely influence the various properties of the final products.

The monomers are generally selected to be rigid or contorted as well as having multifunctional reaction sites. It has been proved that monomers with diversified geometries such as linear, [5] planar [6], tetrahedral [7] and octahedral geometries [8] can meet the demand of rigidity or contortion and thus easily afford the porosity.

Additionally, linking the monomers with different geometries could combine their advantages and further tune the porosity and functionality of the resulting polymers [9]. Among various monomers, tetrahedral monomers have attracted specific interest because porous polymers can be designed to possess high specific surface area using these monomers as building blocks, which can lack the flexibility to pack efficiently thus resulting in facile formation of free volumes to promote the porosity [10,11]. There are mainly two kinds of tetrahedral monomers, *i.e*., carbon-centered and silicon-centered compounds. Compared with carbon-centered analogues, silicon-centered monomers possess unique advantages including facile synthesis, greater flexibility of the molecular structure and easy achievement of higher porosity [12,13]. The environmental issue from the emission of CO_2 caused by burning fossil fuels has been garnered tremendous interest both in academia and industry [14].

The most popular process employed for CO_2 capture is the adsorption using amine solutions such as monoethanolamine and triethanolamine [15], due to its high efficiency and simplicity. However, this process suffers from some drawbacks, such as toxicity, equipment corrosion and high regeneration costs [16]. To this end, porous solid materials including activated carbons, metal organic frameworks (MOFs) [17–20] and porous organic polymers (POPs) [21–24] have been investigated and proven to be viable alternatives for CO_2 capture and storage. Conjugated micro porous polymers (CMPs), first reported in 2007 by Copper et al. [25], are a subclass of POPs that consist of π-conjugated skeletons with Nano porous structures [17]. Different from other porous materials such as porous carbons, CMPs with π-conjugated skeletons and permanent Nano porous structures, has a high structural flexibility and have been attracted considerable attention for CO_2 storage and capture [15-27].

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