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Synthesis of microporous organic polymers from 4,4-Bis chloremetyl-1,1 Biphenyl and Dichloro-p-xylene

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ABSTRACT

This paper reports the preparation and characterization of micropporous organic polymer (MOPs) synthesized from 4,4-Bis (chlorometyl)-1,1 Biphenyl and Dichloro-p-xylene with different ratio of these compounds, through the Friedel-Craft alkylation process promoted by anhydrous $FeCl_3$. The MOPs were characterized by FT-IR, SEM, TGA, and BET. These microporous organic polymers possessed high BET specific surface areas. SBET increased lightly from 1476.36 m^2/g to 1663.02 m^2/g 1 with the increasing content of dichloro-p-xylene, and the pore width average from 55.6 – 44.5 Å. The MOPs are stable at around 400°C.

Introduction

Microporous Organic Polymers (MOPs) are attracting much because of their potential uses in diversified fields such as catalysis [1], gas storage, carbon dioxide capture [2], electrical energy storage [3], light harvesting [4], and separation [5]. MOPs have potential advantages over many other microporous materials because of the scope of synthetic diversity, the attainment of ultrahigh surface areas, and high physicochemical stabilities, especially towards water. MOP-forming reactions are presented at mild synthetic conditions, which allows the incorporation of functionalities such as amines and alcohols, while maintaining high thermal stabilities in the materials. Such functional groups can prove more difficult in other materials, such as metal-organic frameworks (MOFs), since polar groups such as amines and acids can coordinate to the metal centers or be incompatible with solvent-thermal reaction conditions. The particular advantage of MOPs is to introduce a wide range of useful chemical functionalities into the pores [6]. Microporous organic polymers with intrinsic properties, such as large surface area, narrow pore size distribution, high chemical stability, and low skeleton density could be achieved by varying the functionalities through rational choices of organic monomer precursors [7]. Thus, numerous microporous polymer based adsorbents have been developed, mainly using approaches of Friedel-Crafts alkylation, palladium catalyzed Suzuki-Miyaura reactions, Sonogashira-Hagihara and Buchwald-Hartwig cross-coupling reactions, Nickel catalyzed Ullmann coupling reactions, and oxidative coupling polymerization [7]. Nevertheless, it still remains a great challenge to synthesize microporous organic polymers with rational design at molecular level by using cost- effective and simple pathways for the polymerization.

Herein, we report the production of microporous organic polymer network directly from 4,4-Bis (chlorometyl) -1,1 Biphenyl using an oxidative polymerization process. As statistical co-polymerization has been used as a means of tuning the properties of MOPs, we also prepare a series of novel microporous