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Ultrahigh-CO_2 Adsorption Capacity and CO_2/N_2 Selectivity by N-Doped Porous Activated Carbon Monolith

Alabadi Akram
South Refineries Company, Iraq

Hierarchical porous carbon (HPC) monolithic with 3D network has received considerable attention due to their potentially technological application as candidates for electrochemical energy storage devices such as capacitors, lithium ion batteries, solar cells, sorbent for toxic gas separation and greenhouse gas capture for their well-defined pore dimensions and topologies. Synthetic polymer based hierarchical nanostructured carbons are particularly attractive for their consistent pore dimensions which can be adjustable on long length scales, so that diffusibility of guest species could be improved through its unique hierarchical pores. N-doped HPC monoliths exhibit multifaceted features such as tunable textural properties, excellent thermal and chemical stability, which are remarkable physicochemical properties that are answerable for micro/nanostructured porous carbons perfect candidates for emerging substrates in nanotechnology science.

A two-step synthetic method has been developed to achieve functionalized nanoporous carbons via cross-linked polymer precursors, which are prepared by Friedel-Craft alkylation and pyrolysis. Nitrogen-doping proves to be an effective method for reinforcing the CO_2 adsorption capacity of carbon-based adsorbents, although it remains a great challenge to reach a fit doping level of nitrogen (N) and a high porosity in a porous carbon simultaneously. Herein, a facile method that enables the fabrication of ordered microporous nitrogen-doped porous carbon monolith with a content of 4.6 wt% N, which employs poly (H-BINAM) as precursor. Through chemical activation, high microporosity is generated and gives birth to a monolithic structured porous nitrogen-doped carbon. This material exhibits a remarkable CO_2 adsorption capacity (6.74 mmol g-1 at 273 K and 4.27 mmol g-1 at 298 K under 1 bar) and an extraordinarily excellent CO_2/N_2 selectivity (153), which is calculated from the single-component adsorption isotherms based on Henry's Law. This value exceeds the CO_2/N_2 selectivity of thus mentioned for carbon-based adsorbents including diverse nitrogen doped ones, whose attributes are largely associated with the unusually high N-content as well as the partial graphitic framework.

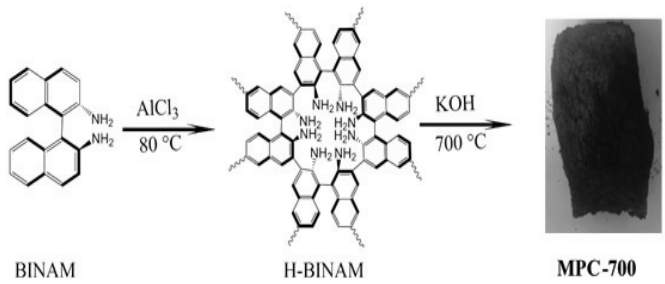

Figure 1: Synthetic procedure of monolithic porous carbon (MPC-700) from BINAM monomer.

Biography:

Dr. Alabadi Akram has the expertise in chemistry of microporous polymers and their applications in petroleum fields, lubricant oils properties and enhanced oil recovery where he contributed over 7 articles. Currently, he is holding the chemist in lube oil department at South Refineries Company, Basra, Iraq. In over 17 years, Dr. Alabadi Akram also has external lecture at university of Basra.