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Sulfur-Doped Hierarchically Porous Boron Nitride Nanosheets as an Efficient Carbon Dioxide Adsorbent

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Abstract : Carbon dioxide gas has been a major cause for the worldwide increase in green house effect, which leads to climate change and global warming. So CO_2 capture & sequestration has become an effective way to reduce the concentration of CO_2 in the environment. One such way to capture CO_2 in porous materials is by adsorption process. A potential material in this aspect is porous hexagonal boron nitride or 'white graphene' which is a well-known two-dimensional layered material with very high thermal stability. It had been investigated that the sample with hierarchical pore structure and high specific surface area shows excellent performance in capturing carbon dioxide gas and thereby mitigating the problem of environmental pollution to the certain extent. Besides, the presence of sulfur as well as nitrogen in the sample synergistically helps in the increase in adsorption capacity. In this work, a cost effective single step synthesis of highly porous boron nitride nanosheets doped with sulfur had been demonstrated. Besides, the CO_2 adsorption-desorption studies were carried on using a pressure reduction technique. The studies show that the nanosheets exhibit excellent cyclic stability in storage performance. Thermodynamic studies suggest that the adsorption takes place mainly through physisorption. The studies show that the nanosheets exhibit excellent cyclic stability in storage performance. Further, the surface modification of the highly porous nano sheets carried out by incorporating ionic liquids had further enhanced the capturing capability of CO_2 gas in the nanocomposite, revealing that this particular material has the potential to be an excellent adsorbent of carbon dioxide gas.

Keywords : CO_2 capture, hexagonal boron nitride nanosheets, porous network, sulfur doping
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