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The adsorption characteristics of helium on different activated carbons at 4.5-77K

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The adsorption isotherms of helium on two kinds of activated carbon in the temperature-pressure range (4.5-77 K, 0.1 -1.0 MPa) have been measured with a cryogenic adsorption device. Most of the existing studies primarily focused on cryopumping or law pressure gas removal processes with very limited research specifically targeting helium isotope separation. Furthermore, all have used liquid helium immersion refrigeration. In this study a cryogenic adsorption device has been established and consisted of a 4 K cryostat (Gifford McMahon (GM) Cryocooler), Setaram gas sorption measurement and a temperature controller. The experimental techniques for obtaining adsorption isotherms have been described in detail in this paper. By analyzing the adsorption curve, the optimal temperature and pressure conditions for helium adsorption can be obtained, better activated carbon adsorbents can be selected, and the isosteric heats of adsorption can be derived from these isotherms. These findings could potentially facilitate the development of helium isotope adsorption separation units.

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