

New acrylic monolithic carbon molecular sieves for O₂/N₂ and CO₂/CH₄ separations

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Abstract

The modification of activated carbon fibres prepared from a commercial textile acrylic fibre into materials with monolithic shape using phenolic resin as binder was studied. The molecular sieving properties for the gas separations CO₂/CH₄ and O₂/N₂ were evaluated from the gas uptake volume and selectivity at 100 s contact time taken from the kinetic adsorption curves of the individual gases. The pseudo-first order rate constant was also determined by the application of the LDF model. The samples produced show high CO₂ and O₂ rates of adsorption, in the range 3–35 · 10⁻³ s⁻¹, and in most cases null or very low adsorption of CH₄ and N₂ which make them very promising samples to use in PSA systems, or similar. Although the selectivity was very high, the adsorption capacity was low in certain cases. However, the gas uptake in two samples reached 23 cm³ g⁻¹ for CO₂ and 5 cm³ g⁻¹ for O₂, which can be considered very good. The materials were heat-treated using a microwave furnace, which is a novel and more economic method, when compared with conventional furnaces, to improve the molecular sieves properties.

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