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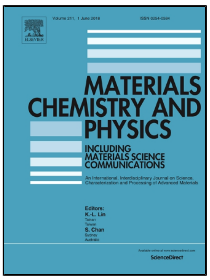

Cu-BTC Synthesis, Characterization and Preparation for Adsorption Studies

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Cu-BTC Synthesis, Characterization and Preparation for Adsorption Studies

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Abstract

In this study, several samples of Cu-BTC, a member of the MOF adsorbent family, were synthesized following synthesis routes that represent some modifications of published recipes. The effects of mixing, reaction temperature and duration, and concentrations of the precursors on the synthesized samples are discussed. The results showed that pre-mixing of the precursors' solutions, higher dilution of the precursors, and modest reaction duration and temperature gave the most stable sample. The sample stability after several CO_2 adsorption-desorption cycles was examined, and the characterization methods: XRD, TGA and SEM were used to describe selected synthesized sample and the commercial one (Basolite® C300). The thermal and mechanical processing effects as well as optimum regeneration temperature and duration were also experimentally determined (423.15 K, 8 hr) for both in-house and Basolite® C300 samples.

Keywords

Synthetic methods, MOF, Cu-BTC, CO_2, Adsorption

1. Introduction

Adsorption separation processes are in widespread industrial use, particularly in the petroleum refining and petrochemical industries. The heart of an adsorption process is the porous solid medium. The porous solid provides a very high surface area or high micropore volume and it is this high surface area or micropore volume that contributes to the high adsorptive capacity. The first major development in the adsorption industry was the invention of zeolites.

The industrial adsorbents are characterized in terms of porosity, surface area, thermal and chemical stability, pore volume, pore size distribution and material density. Activated carbon, synthetic and natural zeolites, silica gel, activated alumina and carbon molecular sieves are the most important industrial adsorbents ([1, 2]).

From the very early days of crystal chemistry it was recognized that the structures of complex crystals could usefully be described in terms of units variously called modules, building units, structural units, or secondary building units. More recently, it has been realized that the assembly of building blocks yields extended structures with designed properties. Therefore, a logical and simple way to combinatorial search

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