

Synthesis of Geopolymer-Based Phase-Pure Analcime and Cancrinite Zeolite via Simple Hydrothermal Method

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Abstract:

It is well-reported that the synthesis of Analcime and Cancrinite zeolites via hydrothermal process requires long treatment reaching up to several days, also, the resulting zeolite is commonly phase impure and has weak mechanical strength. In the current work, Analcime and Cancrinite zeolites were synthesized using a simple hydrothermal method, utilizing metakaolin-based geopolymer as a template and 1 M and 5 M aqueous solutions of sodium hydroxide as a media for the hydrothermal process. The effect of the time and the temperature of the hydrothermal treatment were investigated. Characterization techniques such as X-ray diffraction (XRD), scanning electron microscopy (SEM), and Fourier-transform infrared spectroscopy (FTIR) were employed to assess the synthesized Analcime and Cancrinite zeolites. It has been found that phase-pure Analcime and Cancrinite zeolites can be obtained via the treatment at a temperature of 240°C and 220°C respectively for only 6 hours in NaOH solution, Analcime records a compressive strength of 61 MPa and Cancrinite reaches a compressive strength of 56 MPa. The findings not only establish the viability of geopolymer as a starting material for Analcime and Cancrinite zeolites synthesis but also contribute valuable insights into the key factors influencing the process. This research advances the understanding of zeolite synthesis pathways and expands the potential applications of geopolymers in the realm of zeolite materials.

Keywords:

Analcime, Cancrinite, Geopolymer, Zeolite.