Effect of Synthesis Parameters on Crystal Size and Perfection of Mordenite and Analcime

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Abstract : The aim of this work was to obtain small crystalline size and high crystallinity of mordenites and analcimes, by modifying the aging time, agitation, water content, crystallization temperature and crystallization time. Two different hydrothermal methods were studied. Both methods used Na2SiO3 as the silica source, NaAlO2 as the aluminum source, and NaOH as the alkali source. The first method used HMI as the template while the second method did not use the template. Mordenite crystals with spherical shape and bimodal in size of about 1 and 5 µm were obtained from the first method using conditions of 24 hr aging time, 170°C and 24 hr crystallization. Modernites with high crystallinity were formed using agitation system in the crystallization process. It was also found that the aging time of 2 hr and 24 hr did not much affect the formation of mordenite crystals. Analcime crystals were formed in spherical shape and facet on surface with the size between 13-15 µm by the second method using the conditions of 30 minutes aging time, 170°C and 24 hr crystallization without calcination. By increasing water content, the crystallization process was slowed down and resulted in smaller analcime crystals. Larger size of analcime crystals were observed when the samples were calcined at 300°C and 580°C. Higher calcination temperature led to higher crystal growth and resulted in larger crystal size. Finally, mordenite and analcime was used as fillers in zeolite/Nafion composite membrane to solve the fuel cross over problem in direct alcohol fuel cell.

Keywords : analcime, hydrothermal synthesis, mordenite, zeolite
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