

Development of ZSM-5 Zeolite from Dealuminated Nigerian Ahoko Kaolin

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Abstract

Synthesis of ZSM-5 zeolite has been carried out using dealuminated Nigerian Ahoko kaolin which serves as the source of silica and alumina. The synthesis of ZSM-5 from dealuminated kaolin was a follow up to the earlier work on the synthesis of ZSM-5 zeolite from Nigerian Ahoko Kaolin in which external silica was added to make up for the Si/Al ratio requirement in MFI synthesis. In this work the dealumination of Ahoko metakaolin was carefully carried out to obtain a Si/Al ratio within the range of ZSM-5 starting aluminosilicate gel. Dealuminated kaolin with Si/Al of 16 along with calculated amount of NaOH, deionised water and TPAOH was used to prepare the starting aluminosilicate gel. Hydrothermal reaction was carried out by adopting the best conditions of ZSM-5 synthesis from Ahoko kaolin using external silica. The results show the best condition for the synthesis of ZSM-5 from Nigerian Ahoko kaolin as crystallization time 148h, crystallization temperature 140oC and ageing time as 36h (room temperature). The outcome of ZSM-5 preparation from dealuminated kaolin indicated a highly crystallized ZSM-5 zeolite with similar morphology from the ZSM-5 prepared from the same raw material but with additional silica. This results show that pure phase of ZSM-5 with BET surface area of 262m²/g can be produced from kaolin that is dealuminated. Finally a novel liquid phase transport technique was used to prepare highly crystalline ZSM-5 from dealuminated metakaolin eliminating quartz which was a major weakness of the earlier synthesis of the zeolite from Nigerian Ahoko metakaolin.

Keywords: Hydrothermal synthesis, dealumination, ZSM-5, Nigerian Ahoko kaolin (NAK), X-ray fluorescence (XRF) and Characterisation.

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