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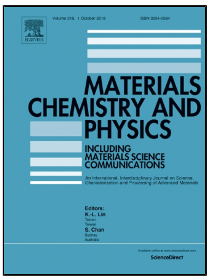

Seed-Assisted Hydrothermally Synthesized AACH as the Alumina Precursors

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Seed-Assisted Hydrothermally Synthesized AACH as the Alumina Precursors

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Abstract: Ammonium Aluminum Carbonate Hydroxide (AACH) is one of the nanostructure materials with a high surface area, which is mostly produced by the hydrothermal method. In this study, kinetics of the hydrothermal reaction has been accelerated with the addition of seed. Nucleation and growth steps have been studied by characterizing the obtained precipitate at different reaction times by FTIR, XRD, FE-SEM, and BET. Different amounts of seeds were added, and the optimum amount in reducing AACH crystallization time has been determined. By seed addition the time required for AACH formation has been reduced from 24h to around 10h, also the specific surface area of the AACH whiskers have been increased about 2.8 times. Mechanism of the reaction and the effect of seed addition have been discussed. Synthesized AACH was calcined at different temperatures to obtain different phases of alumina fibers. The surface area of the obtained Aluminas was investigated by BET; results showed that the highest surface area is achieved when the alumina is in the form of gamma structure.

Keywords: alumina; adsorbent; hydrothermal; surface area; ammonium aluminum carbonate hydroxide

1. INTRODUCTION

Alumina has unique properties such as high melting point, high elastic modulus, chemical inertness and etc. Therefore it is widely used in various applications such as adsorbents, ceramics, thermal insulators, membrane and catalyst [1-3]. Total world production of alumina is about 65 Mt annually and is mostly produced by Byer process. However, efforts have been made to produce alumina nanostructures with a variety of morphologies (belts, tubes, rods, wires, whiskers, sheets, etc.) with thermal evaporation, chemical etching, sol-gel methods, continuous anodizing, and hydrothermal methods [4-7]. Recently, several authors have surveyed production of α-Al2O3 from thermal decomposition of Ammonium Aluminum Carbonate Hydroxide (AACH) [8-12]. AACH is an ammonium-type dawsonite (NH4Al(OH)2CO3) with a base-centered orthorhombic unit cell (Imam space group). The structure of AACH is composed of Al-O octahedrons that are connected by the strong covalent bond that would create Al-O sheets along the c-axis of