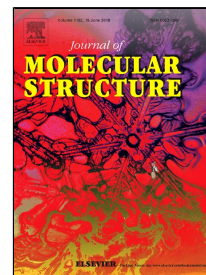


# Accepted Manuscript

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## Effect of thermal processing on the structural characteristics of fly ashes

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### Abstract

This work investigated the course of fly ash's glassy phase crystallization in terms of structural and thermal changes. On the basis of XRD studies the olivine and albite phases are formed after the second step of the heat treatment. XRD/Rietveld analysis confirmed increased amount of mullite. The occurrence of crystallizing phases depends on the chemical composition of fly ash. It was observed that under the heat treatment of fly ashes with a small amount of modifying oxides a larger mullite superstructure appeared, what favors the albite rich plagioclases formation. The structural changes upon the heat treatment of fly ashes were studied by means of <sup>27</sup>Al MAS NMR and FTIR spectroscopy. On the basis of NMR studies it has been confirmed that aluminum ions in devitrified glassy phase occurred only in the tetrahedral positions.

**Keywords:** fly ash, mullite, plagioclase, olivine, crystallization process.

### 1. Introduction

Fly ash originating from conventional combustion of coal dust in pulverized coal-fired boilers belongs to waste group with a wide range of applications in industry, mainly in building materials. The chemical properties of the fly ash are largely influenced by the chemical content of the coal burned (i.e., anthracite, bituminous, and lignite). Fly ash containing less than 10% lime CaO is pozzolanic in nature, thus possessing pozzolanic properties, the glassy silica and alumina requires a cementing agent, such as Portland cement, quicklime, or hydrated lime, with the presence of water in order to react and produce cementitious compounds [1]. It is commonly used as a pozzolanic component in cement [2-4], an addition to commodity concrete [4-6], a raw material for the production of autoclaved aerated concrete [7] and finally as an additive for ceramic mass in the sintered ceramics industry [8-11]. Especially interesting is the latter application considering the fact that fly ash has already had its thermal past as it was made from minerals containing coal which were subjected to rapid thermal processes during coal combustion. It is worth to mention that coal is grounded before burning which essentially ensures the fine grains of the ashes. Coal combustion temperature in pulverized coal-fired boilers ranges between 1200°C-1400°C and

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