

Abstract

Coal Fly Ash Zeolites—From Synthesis to Application in Acetone Optical Detection †

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Recently, a widely used method for recycling fly ash waste of coal collected from the electrostatic precipitators has been the synthesis of zeolites from this waste material. Subsequently, zeolites can be used for a variety of purposes, but one that is gaining a growing amount of interest is the use of their porous structure for the detection of volatile organic compounds. In this study, fly ash of lignite coal collected from the electrostatic precipitators of one of the largest TPPs in Bulgaria was used as a raw material for the synthesis of zeolites of Na–X type via ultrasonic-assisted double-stage fusion–hydrothermal alkaline conversion.

In order to reduce the size of the synthesized zeolites and, therefore, improve the quality of the composite thin films, as well as to study the influence of zeolites’ sizes on the sensing properties, the synthesized zeolites were wet-milled at three different durations. All zeolite powders were studied from the viewpoint of their surface morphology and structure via scanning electron microscopy and X-ray diffraction, respectively. The porosity and particle size of Na–X zeolites prior to and after milling were investigated using N₂-physisorption and dynamic light scattering, respectively.

Zeolites thus obtained (milled and not-milled) were used to produce composite thin films based on sol–gel niobium pentoxide (Nb₂O₅). A complete optical characterization of the thin films was made, and their sensing properties with respect to acetone vapor were studied. The change in the reflection coefficient ΔR of the films was calculated from measured reflectance spectra of the films prior to and after exposure to the selected vapors.

Supplementary Materials: The poster presentation can be downloaded at: https://www.mdpi.com/article/10.3390/IOCC_2022-12159/s1.

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