Synthesis of Nepheline from Different Zeolites Prepared from an Aluminum Waste

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Abstract

Nepheline, (Na,K)AlSiO4, is a feldspatoide mineral with excellent mechanical properties, which is used in many industrial applications, specially those relate to the manufacture of glass and ceramics. Nepheline can be obtained by thermal transformation of materials rich in Na, Al and Si as zeolites. This transformation is a complex process that is affected by several factors among others the zeolite structure, the Si/Al ratio, the water content and the extra framework cations. The different mineralogical, chemical, and structural changes occurred during the transformation of zeolite to nepheline, are principally caused by migration and/or ejection of atoms from the crystal lattice of the zeolite, causing chemical stoichiometry variations as well as expansion or contraction of the material.

The objective of this paper was to study the transformation of four zeolites, Ana, NaP1, LTA and, SOD into nepheline by thermal treatment. All the zeolites were prepared through a one-step hydrothermal synthesis method, using an Al-rich waste coming from the aluminum slag milling process as the only Al source. The aluminum waste is considered hazardous because of its high reactivity in the presence of water or environmental humidity.

The thermal behavior of the parent zeolites was followed by differential thermal analysis and thermogravimetric (DTA-TG). Selected temperature values were used for the treatment of the zeolite in a muffle to a fixed time. Then, the samples of nepheline obtained were studied by XRD, FESEM and FTIR and the effect of the Al-waste zeolites on the morphological and microstructural characteristics of the nepheline was determined.

Biography:

Dr. Aurora López-Delgado (Ph.D in Chemistry, Scientific Researcher at Eduardo Torroja Institute for Construction Science, IETcc-CSIC) has more than 25 years of experience in the synthesis of added-value materials such as glasses, glass-ceramics, ferrites, aluminas, zeolites, etc., using hazardous waste as raw materials. She has co-authored more than 150 scientific publications, 10 patents, and around one hundred presentations at international conferences.

Her current research interest includes processing and technological characterization of industrial and mining wastes in order to develop processes to get added-value materials, and also, in the application of concentrated solar energy to high temperature processes.