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Thermal behavior of Sr-analcime synthesized from by-products of the Amazonian mineral industry

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After the accidents in Mariana (2015) and Brumadinho (2019), there is constant concern about the generation, storage and management of mining tailings. In the Amazon region, these by-products are generated in different mineral processing processes, with different chemical-mineral compositions. Studies into their technological characterization and transformation into value-added products are of great importance as they can help to minimize their environmental impact in the region. In this work, tailings from the aluminum (bauxite) and Si industries located in the state of Pará were characterized and transformed successfully into zeolite with a Sr-analcime structure, after hydrothermal synthesis followed by an ion exchange process. Thermoanalytical (TGA-DSC) and high-temperature X-ray diffraction (HT-XRD) analyzes were carried out to investigate the thermal behavior of Sr-analcime in the range of 25–1000 °C. In accordance with the results obtained, it was revealed that, during heating, two endothermic peaks at 80 and 315ºC could be well correlated to the loss of sorption water molecules and within the Sr-analcime tunnels with a tetragonal system, which changed to the orthorhombic system close to 585º C, as revealed by a broad endothermic peak. In the range of 600 to 1000º C, two more important exothermic events were identified: transformation of orthorhombic analcime into an amorphous phase and recrystallization into feldspar (nepheline). These results showed that unwanted products from the mining sector can be an interesting low-cost raw material for producing zeolite with specific thermal properties, which is of great technological importance.