The effect of Si on thermal transformation of iron (oxyhydr)oxide nanominerals

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The thermal transformation of unstable iron (oxyhydr)oxide nanominerals strongly depends on many parameters such as size, surface area, shape, temperature, structural defects and chemical composition. Thus, the conversion from iron (oxyhydr)oxide into hematite is highly dependent on these factors. For instance, the equilibrium transformation temperature of iron (oxyhydr)oxide phases increases with decreasing the size of the particles and increasing the surface area or water content. The results of previous reports indicate that Si may aggregate particles while lowering the size and shape of the precursor aggregate. The presence of Si in iron (oxyhydr)oxides hampers their transformation to hematites by affecting the rate and the mechanism of this reaction. However, the transformation pathways of these minerals are not well understood. The aim of this research was to characterize the effect of Si on thermal transformation of ferrihydrite $Fe_5HO_8 \cdot 4H_2O$, feroxyhyte δ-FeOOH and akaganéite β-FeOOH into hematite α-Fe_2O_3. Ferrihydrite, feroxyhyte and akaganéite of increasing Si/Fe molar ratios (0.00, 0.20, 0.50 and 1.00) were synthesized by direct co-precipitation methods in the presence of appropriate Si concentrations. The thermal decomposition processes of samples were studied at various heating temperatures using simultaneous thermal analysis. All samples were characterized by XRD, FTIR, SEM prior and after the experiments. The preliminary results of research indicate that the transformation of Si-ferrihydrites is much more complex than in the case of Si-feroxyhites and Si- akaganéite.

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