Dehydroxylation of Aluminous Goethite: Unit Cell Dimensions, Crystal Size and Surface Area

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Abstract: This work investigates unit cell dimensions, crystal size and specific surface area of aluminous goethite that was progressively dehydroxylated to form hematite. Goethite synthesized from the ferrous system altered to hematite with DTGA maximum increasing from 236 ° to 273 ° C for 0 to 30.1 mole % Al-substitution. Unit cell dimensions of goethite and hematite decreased as Al-substitution increased and increased as excess OH increased. The crystallographically equivalent a axis of goethite and c axis of hematite were more sensitive than other axes to the presence of excess structural OH associated with Al-substitution. Specific surface area increased from 147 to 288 m^2/g for goethite and from 171 to 230 m^2/g for hematite as Al-substitution increased. An increase in specific surface area on heating goethite at temperatures between 200 ° and 240 ° C is related to a decrease in the size of coherently diffracting domains of goethite crystals and to the development of pore and structural defects associated with the formation of hematite. The decrease in specific surface area for heating temperatures above 240 ° C is attributed to the growth of hematite crystals by diffusion.

Key Words: Al-substitution • Crystal size • Dehydroxylation • Goethite • Hematite • Specific surface area • Unit cell

Clays and Clay Minerals; April 1995 v. 43; no. 2; p. 196-211; DOI: 10.1346/CCMN.1995.0430207

Clay Minerals Society (www.clays.org)