
Quantitative Determination of Aluminum-Substituted Goethite-Hematite Mixtures by Mössbauer Spectroscopy

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Abstract: Mixtures of synthetic Al-substituted goethite ($\alpha\text{-Fe}_{0.814}\text{Al}_{0.186}\text{OOH}$) and hematite ($\alpha\text{-Fe}_{1.658}\text{Al}_{0.342}\text{O}_3$) (75, 50, 25, 3% hematite by weight) were studied by Mössbauer spectroscopy to evaluate the use of that technique for quantitative analysis. Mössbauer spectra for these mixtures, obtained in the temperature range 12–130 K, were better fitted by a distribution of magnetic fields than by two magnetic sextets. Spectra at 80 K were equally as good as those from lower temperature to determine the hematite-goethite ratio. The recoil-free fractions of the individual components were about equal at any fixed temperature, but thickness effects caused as much as 30% error in the determination of the ratio of components in mixtures.

Key Words: Aluminum • Goethite • Hematite • Mössbauer spectroscopy • Quantitative mineralogy

Clays and Clay Minerals; June 1986 v. 34; no. 3; p. 250-256; DOI: [10.1346/CCMN.1986.0340304](https://doi.org/10.1346/CCMN.1986.0340304)

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