
Measurement of Fundamental Illite Particle Thicknesses by X-ray Diffraction Using PVP-10 Intercalation

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Abstract: The thicknesses of fundamental illite particles that compose mixed-layer illite-smectite (I-S) crystals can be measured by X-ray diffraction (XRD) peak broadening techniques (Bertaut-Warren-Averbach [BWA] method and integral peak-width method) if the effects of swelling and XRD background noise are eliminated from XRD patterns of the clays. Swelling is eliminated by intercalating Na-saturated I-S with polyvinylpyrrolidone having a molecular weight of 10,000 (PVP-10). Background is minimized by using polished metallic silicon wafers cut perpendicular to (100) as a substrate for XRD specimens, and by using a single-crystal monochromator. XRD measurements of PVP-intercalated diagenetic, hydrothermal and low-grade metamorphic I-S indicate that there are at least 2 types of crystallite thickness distribution shapes for illite fundamental particles, lognormal and asymptotic; that measurements of mean fundamental illite particle thicknesses made by various techniques (Bertaut-Warren-Averbach, integral peak width, fixed cation content, and transmission electron microscopy [TEM]) give comparable results; and that strain (small differences in layer thicknesses) generally has a Gaussian distribution in the log-normal-type illites, but is often absent in the asymptotic-type illites.

Key Words: Bertaut • Fundamental Illite Particles • Illite • Illite-Smectite • Mixed-Layering • Peak Broadening • Polyvinylpyrrolidone • Warren-Averbach • X-ray Diffraction

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