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# Direct Imaging of Zirconia Pillars in Montmorillonite by Analytical Electron Microscopy

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**Abstract:** Analytical electron microscopy was used to confirm the location of pillars of zirconia in pillared montmorillonite. Data show that the pillared clay is of “ high” quality, with surface areas ranging from 200 to 250 m<sup>2</sup>/g and (001) spacings in the 17– 18 Å range. The zirconia-rich pillars were observed using bright-field imaging, annular dark-field imaging, and energy-filtered imaging. The composition of the pillars was confirmed by performing nano-analysis using energy-dispersive X-ray spectroscopy and electron energy-loss spectroscopy. The pillars apparently have an irregular shape <50 Å in size. The shape and relatively large size of the pillars suggest that zirconia dispersion is not ideally distributed in this sample. This study is apparently the first report of electron microscopy observation of pillaring material in clays.

**Key Words:** Clays • Electron Energy-Loss Spectroscopy • Elemental Mapping • Energy-Filtered Imaging • Image Analysis • Materials Characterization

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