
¹³C CPMAS Nuclear Magnetic Resonance Study of the Adsorption of 2-Phenethylamine on Clays

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Abstract: 2-Phenethylamine ¹³C-enriched in the beta position was adsorbed on four different aluminum-exchanged clays: hectorite, Barasym, Laponite RD, and lithium taeniolite. The sites for adsorption were characterized by ¹³C high-resolution cross-polarization magic angle spinning nuclear magnetic resonance (CPMAS-NMR) spectroscopy. Using differences in chemical shift values and linewidths, three different types of bound ammonium compounds and a motionally restricted bound compound were identified. Correlation with charge effects indicated that one of the clay sites was extremely acidic.

The important catalytic sites for the different clays, the edge or platelet face, interlamellar and some combination of both, were probed by using the trimethylsilyl group as a day-blocking agent. Silylation of aluminum-exchanged Laponite RD and Li taeniolite had little effect on amine adsorption. This indicates that, for these clays, amine adsorption occurred mainly at interlamellar sites. For hectorite, amine adsorption occurred at both surface and interlamellar sites, and silylation had the effect of reducing surface adsorption. Silylation of Barasym resulted in a very interesting shift of adsorption from one kind of surface site to a more acidic surface site.

Key Words: Amine reactions with clays • Clay acidic sites • Solid state NMR

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