
Interlayer Cations as Reaction Directors in the Transformation of Limonene on Montmorillonite

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Abstract: Clays may catalyze chemical reactions by acting as Brönsted acids, Lewis acids, and/or Lewis bases. The changes occurring when limonene (p-menthadiene) is heated in the presence of montmorillonite illustrate how Brönsted and Lewis acidity may operate competitively, the nature of the interlayer cations determining which reaction dominates. The rate at which the starting material disappears increases with the acidity of the clay, which depends upon the interlayer cations (Na < Mg < Al < H). The concentration of disproportionation and isomerization products reaches a maximum after reaction times which decrease with increasing surface acidity of the clay. p-cymene is produced by oxidation in concentrations inversely related to the surface acidity of the clay. The course of the chemical reaction can thus be steered in the preferred direction by an appropriate choice of interlayer cations.

Key Words: Catalysis • Cation • Disproportionation • Isomerization • Limonene • Montmorillonite

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