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Optimisation of the preparation of an Al-pillared clay: thermal stability and surface acidity

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Abstract

The intercalation of montmorillonite by aluminium requires the use of aluminium chloride as a precursor for the intercalation solution. The best samples were obtained with an Al/OH ratio = 2, a pH of 5.6 and an Al/clay ratio = 5 mmol/g. High surface area materials were obtained with good thermal stability after calcination at 773 K. A study of the acidity of surface groups showed that the Al_{13} polycation is transformed into a specific form of Al oxyhydroxide with amphoteric properties. The data, when treated in the '1 site, 2 pK' model, may be interpreted by the existence of surface species of type $\{AlOH(OH_2)\}$, having two constants of deprotonation $K_{a1} = 10^{-5}$ and $K_{a2} = 0.32 \cdot 10^{-6}$. An alternate treatment in terms of the 'multisite, 1 pK' model recently developed by Jagiello et al. is also discussed. © 1997 Elsevier Science B.V.

Keywords: intercalation; pillared clays; surface acidity; hydroxilic surface groups

1. Introduction

Clays can be intercalated by metal polycations through ion exchange reactions, yielding materials with high microporosity and surface area. For example, Al intercalation of a clay consists in the insertion between the layers of 'Al_{13}'

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