Chemisorption of Copper on Hydroxy-Aluminum-Hectorite: An Electron Spin Resonance Study

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Abstract: Copper adsorption on a hydroxy-aluminum-hectorite complex (OH-Al-hectorite) at pH 4.5, 5.7, 7.4, and 7.8 was examined by means of electron spin resonance. The spectra of these samples were compared to those of Cu^{2+}-hectorite and various aluminum hydrous oxides. Copper on the OH-Al-hectorite in aqueous gels occurred as mobile $Cu(H_2O)_6^{2+}$ and chemisorbed to discrete sites of the OH-Al interlayer. As pH was increased, the ratio of chemisorbed to mobile Cu^{2+} increased. At pHs above 7 the solubility product of $Cu(OH)_2$ was exceeded, but chemisorbed Cu^{2+} remained as the dominant species. These results contrast with the precipitation of Cu observed on microcrystalline gibbsite above pH 5 and indicate that the interlayer OH-Al retained more Cu^{2+} on discrete sites. The greater adsorption capacity probably resulted in part from a higher specific surface area. Electron spin resonance spectra of Cu^{2+} in air-dried films of the OH-Al-hectorite at pH 4.5 and 7.4 showed Cu^{2+} in square planar symmetry, oriented with the *z*-axis perpendicular to the OH-Al-hectorite a − b plane. At the higher pH, the spectrum resembled that of $Cu(OH)_4^{2-}$ on alumina, suggesting a ligand exchange mechanism for Cu^{2+} adsorption on the complex.

Key Words: Adsorption • Aluminum • Copper • Electron spin resonance • Hectorite • Hydroxy-aluminum complex

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