Cu^{2+}-Adsorption Characteristics of Aluminum Hydroxide and Oxyhydroxides[1]

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Abstract: The nature of Cu^{2+} adsorption by boehmite, gibbsite, and noncrystalline alumina was studied over a range of equilibrium pH (4.5 – 7.5) and Cu^{2+} concentration ($10^{-3} - 10^{-8}$ M) by electron spin resonance (ESR). Available chemisorption sites at pH 4.5 were the most numerous for noncrystalline alumina (~1 mmole/100 g), less for boehmite, and least for gibbsite as indicated by the relative strength of the rigid-limit ESR signal attributed to Cu^{2+} adsorbed at discrete sites. The chemisorption process involved immobilization of Cu^{2+} by displacement of one or more H_2O ligands by hydroxyl or surface oxygen ions, with the formation of at least one Cu-O-Al bond. As the pH was raised from 4.5 to 6.0, essentially all of the solution Cu^{2+} appeared to be adsorbed by the solids. However, the noncrystalline alumina and boehmite chemisorbed much of the total adsorbed Cu^{2+} (10 mmole/100 g), whereas precipitation or nucleation of $Cu(OH)_2$ in the gibbsite system was indicated. Precipitated Cu^{2+} was more readily redissolved by exposure to NH_3 vapor than chemisorbed Cu^{2+}.

Key words: Adsorption • Alumina • Aluminum • Boehmite • Copper • Electron spin resonance • Gibbsite

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