
Electrodes Modified with Synthetic Clay Minerals: Electrochemistry of Cobalt Smectites

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Abstract: Hydrothermal treatment of a mixture of silicic acid, cobalt chloride, sodium dithionite and sodium hydroxide at 250 ° C under 500 psi of argon produced a pink solid. X-ray powder diffraction (XRD), transmission electron microscopy (TEM) and electron diffraction data showed the product to be a well-crystallized smectite. SEM/EDX analysis gave a unit cell formula of $[(\text{Si}_{8.05})(\text{Co}_{5.58})\text{O}_{20}(\text{OH})_4]\text{Na}_{0.66}$. Heating the same mixture at 150 ° C without argon gave a less well ordered smectite of composition $[(\text{Si}_{7.93})(\text{Co}_{5.92})\text{O}_{20}(\text{OH})_4]\text{Na}_{0.42}$. Two peaks were observed in the cyclic voltammograms of electrodes modified with films of these two clays recorded for the blank electrolytes in the absence of any adsorbed electroactive species. The first peak was attributed to the oxidation of a small fraction of the Co^{2+} sites within the clay lattices to Co^{3+} . The second peak was assigned to further oxidation of these Co^{3+} to Co^{4+} .

Key Words: Clay-modified Electrodes • Cobalt • Cyclic Voltammetry • Smectites • Synthetic Clay

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