Syntheses of Disordered and Al-rich Hydrotalcite-Like Compounds

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Abstract: Hydrotalcite-like compounds, $[Mg_{1-x}Al_x(OH)_2]^{x+}$ $[xX^- \cdot n H_2O]$, where $X^- = ½ CO_3^{2-}$ or OH^-, were prepared by hydrothermal syntheses at P_{H_2O} = 100 MPa and T = 100 ° − 350 ° C. Starting materials were MgO, γ-Al_2O_3, H_2O, and $MgC_2O_4 \cdot 2H_2O$. The synthesis depended on temperature, pressure, the Al/(Al + Mg) ratio x, and the CO_2 content of the starting material. Previously an Al content of x = 0.33 was thought to be the upper limit in these double-layer compounds, but by using pressure the Al-content was increased to x = 0.44. Up to x = 0.33, a_0 decreased linearly to about 3.04 Å, but for x $\geqslant$0.33, a_0 remained nearly constant at this value. For the synthesized products the layer thickness c' varied between 7.40 and 7.57 Å in contrast to the natural phases wherein c' varies from 7.60 to 7.80 Å. At higher temperatures CO_2-free syntheses, i.e., those without Mg-oxalate, resulted in a disordered hydrotalcite-like phase. The transition temperature between the ordered and the disordered hydrotalcite-like phase depended on the Al-content, x.

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