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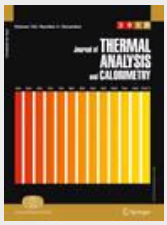

Synthesis and thermal stability of hydrotalcites containing manganese

期刊	Journal of Thermal Analysis and Calorimetry
出版社	Akadémiai Kiadó, co-published with Springer Science+Business Media B.V., Formerly Kluwer Academic Publishers B.V.
ISSN	1388-6150 (Print) 1572-8943 (Online)
学科	Chemistry, Sciences, Polymer Sciences, Physical Chemistry, Inorganic Chemistry, Measurement Science, Instrumentation
期	Volume 100, Number 3
页	981-985
DOI	10.1007/s10973-009-0402-z
Subject Group	化学和材料科学
在线日期	2009年8月28日

PDF (361.8 KB) HTML First Page Preview

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摘要

Abstract
The hydrotalcite based upon manganese known as charmarite $Mn_4Al_2(OH)_{12}CO_3{\cdot}3H_2O$ has been synthesised with different Mn/Al ratios from 4:1 to 2:1. Impurities of manganese oxide, rhodochrosite and bayerite at low concentrations were also produced during the synthesis. The thermal stability of charmarite was investigated using thermogravimetry. The manganese hydrotalcite decomposed in stages with mass loss steps at 211, 305 and 793 °C. The product of the thermal decomposition was amorphous material mixed with manganese oxide. A comparison is made with the thermal decomposition of the Mg/Al hydrotalcite. It is concluded that the synthetic charmarite is slightly less stable than hydrotalcite.

Keywords

Charmarite, Rhodochrosite, Hydrotalcite, Hydrocalumite, Synthesis, Thermal stability

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1. Frost, Ray L. (2011) Thermal stability of stercorite H(NH4)Na(PO4) • 4H2O : A cave mineral from Petrogale Cave, Madura, Eucla, Western Australia. *Journal of Thermal Analysis and Calorimetry* [CrossRef]
2. Frost, Ray L. (2011) Thermal Stability of newberyite Mg(PO3OH) • 3H2O : A cave mineral from Skipton Lava Tubes, Victoria, Australia. *Journal of Thermal Analysis and Calorimetry* [CrossRef]
3. Frost, Ray L. (2011) Thermal stability of crandallite CaAl3(PO4)2(OH)5 • (H2O) : A ‘Cave’ mineral from the Jenolan Caves. *Journal of Thermal Analysis and*

J Therm Anal Calorim (2010) 100:981–985
DOI 10.1007/s10973-009-0402-z

Synthesis and thermal stability of hydrotalcites containing manganese

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Received: 31 May 2009 / Accepted: 29 July 2009 / Published online: 28 August 2009

Abstract The hydrotalcite based upon manganese known as charmarite $Mn_4Al_2(OH)_{12}CO_3 \cdot 3H_2O$ has been synthesised with different Mn/Al ratios from 4:1 to 2:1. Impurities of manganese oxide, rhodochrosite and bayerite at low concentrations were also produced during the synthesis. The thermal stability of charmarite was investigated using thermogravimetry. The manganese hydrotalcite decomposed in stages with mass loss steps at 211, 305 and 793 °C. The product of the thermal decomposition was amorphous material mixed with manganese oxide. A comparison is made with the thermal decomposition of the Mg/Al hydrotalcite. It is concluded that the synthetic charmarite is slightly less stable than hydrotalcite.

Keywords Charmarite · Rhodochrosite · Hydrotalcite · Hydrocalumite · Synthesis · Thermal stability

Introduction

Hydrotalcites have been known for an extended period of time [1–3]. Hydrotalcites, or layered double hydroxides (LDH) are fundamentally known as anionic clays [4]. Hydrotalcites containing manganese are known [5–8]. The natural mineral is known as charmarite [9]. The application of hydrotalcites containing manganese rests with their application in catalyst science [7, 10–15]. Some of these types of materials are used for adsorption and chemical storage [8, 16, 17]. However the synthesis and characterization of hydrotalcites containing manganese remains unexplored and not studied.

Hydrotalcites consist of stacked layers of metal cations (M^{2+} and M^{3+}) similar to brucite ($Mg(OH)_2$). The structure of hydrotalcite can be derived from a brucite structure ($Mg(OH)_2$) in which e.g. Al^{3+} or Fe^{3+} (pyroaurite-sjögrenite) substitutes a part of the Mg^{2+} [2, 18–20]. This substitution creates a positive layer charge on the hydroxide layers, which is compensated by interlayer anions or anionic complexes. In general any divalent cation could substitute for the Mg^{2+} in the brucite-like layer, including Mn^{2+}. Hydrotalcites consist of stacked layers of metal cations (M^{2+} and M^{3+}) similar to brucite ($Mg(OH)_2$). For hydrotalcite-like structures, the substitution of divalent cations for trivalent ones (of similar radii), gives rise to a positive charge on the brucite-like layers. In hydrotalcites a broad range of compositions are possible of the type $\left[M^{2+}{}_{1-x}M^{3+}{}_x(OH)_2\right]_{x/n}\cdot yH_2O$, where M^{2+} and M^{3+} are the di- and tri-valent cations in the octahedral positions within the hydroxide layers with x normally between 0.17 and 0.33. A^{n-} is an exchangeable interlayer anion [21]. The positively charged hydroxyl layers are neutralised through the intercalation and adsorption of anionic species, therefore stabilising the structure. Anions that are intercalated between the hydroxyl layers need to meet certain criteria, including having a high charge density and small anionic radius.

This study is focused upon the synthesis, characterisation of hydrotalcites with manganese substituting for magnesium in the brucite layer of hydrotalcites.

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Calorimetry
[CrossRef]

4. Park, Yuri (2011) A thermoanalytical assessment of an organoclay. *Journal of Thermal Analysis and Calorimetry*
[CrossRef]
5. Frost, Ray L. (2011) Thermal stability of the ‘cave’ mineral ardealite Ca2(HPO4)(SO4) • 4H2O. *Journal of Thermal Analysis and Calorimetry*
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Frontiers in Organic Synthesis Technology 3. - FROST 3