

[\[back\]](#)

PROTONIC MOBILITY IN SYNTH. HYDROTALCITES

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The protonic mobility in synthetic hydrotalcites of various chemical composition has been investigated. High temperature X-ray diffraction, DSC, impedance spectroscopy, FTIR and ¹H-NMR were applied.

Hydrotalcites have a distinct layer structure [1]. The general chemical formula for a 2:1 (Me²⁺/Me³⁺=2:1) hydrotalcite is



The A⁻-position is occupied by interlayer anions like Cl⁻, NO₃⁻, SO₄²⁻ etc.

They are necessary for the charge compensation at the Me³⁺-cations which are located on Me²⁺-positions. Me(OH)₆-octahedral layers vary with interlayers, in which additional anions and water molecules are located.

Including the water molecules on the particle surfaces there are three different proton sources which show characteristic behaviour with increasing temperature.

Until 373 K the adsorbed water is mainly responsible for protonic mobility. When the particle surfaces are dry, the intercalated water contributes to the conductivity. Upon further increase of temperature up to nearly 430 K this source also disappears (depending from the chemical composition of the investigated hydrotalcite).

Above 430 K the hydrotalcite is dry; the conductivity, for example, decreases by several decades. In FTIR no H₂O bands can be observed. At nearly 450 K a partial transformation of the hydrotalcite structure into the brucite structure occurs. Some of the interlayer anions disappear and therefore the layer distance decreases. At ca. 550 K the former hydrotalcite structure has been converted to a three-dimensional network [2] of octahedrons connected by O²⁻-ions which were formed by oxidation of OH-groups.

1. Allmann, R. (1969), N. Jahrb. f. Miner., 544-551
2. Bellotto, M., Rebours, B. et al. (1996), J. Phys. Chem., 100, 8535-8542

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