TUNEABLE LDHs

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Layered Double Hydroxides (LDHs) are composed of alternating positively-charged mixed metal M^{II}-M^{III} hydroxide layers and interlayers occupied by anions (A^{y-}) and water molecules. The metal cations in the layers are coordinated by six oxygen atoms forming 2-D structures of the face-linked oxygen octahedra. The general formula of the most common LDHs can be represented as $[M^{II}_{1-x}M^{III}_{x}(OH)_2]^{x+}(A^{y-})_{x/y}\cdot zH_2O$, where z is an amount of crystal water per formula unit. The parameters x and z can vary over a rather wide range and thereby enable a flexibility of LDH structure allowing intercalation of anions of different nature (either inorganic or organic), size, configuration and charge. As a result, the characteristic layer-interlayer scale in LDHs can be from about 0.7 nm to several nanometers.

The general feature of LDHs is their unique anion exchange ability. The anions intercalated into interlayers can be substituted (in either *reversible* or *irreversible* way) by other anions or combinations of different anions. The exchange direction and rate depend on both the nature of the involved anions and the external factors, such as temperature, concentration, pH *etc*. The controllable exchange ability of LDHs finds use in sensing, corrosion protection, water treatment and other areas. In all these applications, the cation composition of the LDH hydroxide layers is usually unconsidered since it has no (or negligible) impact on the anion exchange. At the same time, particular cations in the oxygen-octahedra layers of the LDHs can offer additional functionality or even new properties.

We report on the systematic study of magnetic properties of LDHs containing cations Co(II), Fe(III) or Al(III). Layered double hydroxides intercalated with anions of different size, shape and charge (including paramagnetic anions) were prepared and investigated. Magnetic characteristics of these LDHs were measured and correlated to the chemical composition and the crystal structure. We show that although the magnetic properties of LDHs are mainly determined by the nature of the paramagnetic anions and their ratio, $(1-x)/x$, the magnetic characteristics can be reversibly tuned by variation of the interlayer distance through anion exchanges and control of the crystal water content.

The obtained LDHs are examples of *tuneable nanomagnets* and considered as promising models to study magnetic interactions in 2-D systems.

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