Design of Heterostructured Molecular Magnets Based on Layered Double Hydroxides

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Thesis Abstract

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Thesis Title

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Thesis Summary

Tunable molecular magnets are promising materials for magnetic recording media. For example, photo-controllable magnetic materials would enable orders-of-magnitude increase in information storage density. Moreover, photo-generation and photo-control of spins can enhance a speed in spintronics and spin-photonics based processing. Along these lines, two requirements should be considered to design such tunable molecular magnets; (1) A suitable molecular framework is prepared for tuning the magnetic properties. (2) Photoactive materials are confined into such a molecular framework in a well-defined manner. In this thesis, two types of heterostructured molecular magnets were designed, which are based on the layered double hydroxides framework.

In chapter 1, research background and previous studies are summarized to highlight this study. Brief introduction is provided for molecule-based magnets, layered double hydroxides, and magnetic heterostructures.

In chapter 2, the magnetic heterostructure was prepared by an organic-inorganic hybrid approach, where *n*-alkylsulfonate anions were intercalated into the magnetic cobalt-nickel layered double hydroxides. Systematic variations in the interlayer spacing of the layered double hydroxides enabled to investigate the structure-dependent magnetic properties. In this magnetic heterostructure, the coercive fields changed as the interlayer spacing increased. Especially for the large interlayer spacing, a dimensional crossover of the magnetic ordering occurred as reflected by a dramatic change in the coercive field.

In chapter 3, the photo-magnetic heterostructure was prepared through intercalation chemistry, where the photo-magnetic cobalt-iron Prussian Blue analogue was grown in the diamagnetic magnesium-aluminum layered double hydroxides. Due to a two-dimensional interlayer gallery of the layered double hydroxides, growth of cobalt-iron Prussian Blue analogue was confined two-dimensionally. Even in the two-dimensional structure, cobalt-iron Prussian Blue analogue exhibited photo-induced magnetization.

In chapter 4, results are summarized, and future perspectives are offered especially for functionalization of magnetic layered double hydroxides through intercalation chemistry.