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Organic/Inorganic and Bio/inorganic Heterostructured Nanohybrids

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We have successfully synthesized organic-inorganic and bio-inorganic nanohybrids by applying an intercalation technique systematically to Bi-based cuprate superconductors, Bi2Sr2Cam-1CumOy (m =1, 2, and 3; BSCCO), and to layered double hydroxides(LDHs), those which are of high importance in terms of basic understanding of intercalation reactions and of their practical applications. The organic-inorganic hybrids were achieved via intercalative complexation, where the pre-intercalated metal halide reacts with the organic salt of Py-CnH2n+1I (Py = pyridine). Dc magnetic susceptibility measurements and X-ray absorption spectroscopic (XAS) studies revealed that Tc evolution is closely related to the changes in electronic structure of inorganic host matrix as well as guest species. we also achieved superconducting colloidal suspension from the organic-intercalates, from which the fabrication of high-quality superconducting thin film could be realized. The intercalative complexation adopted in this work is expected to be a new route to the nanocomposite with unique structure and property unattainable by various conventional methods.

We were also able to demonstrate that the biomolecules such as CMP, AMP, GMP, even DNA and FITC can be hybridized with an inorganic layer compound like LDH, giving rise to nanohybrids which consist of biomolecular layer and inorganic hydroxide one alternatively. And it was found that the biomolecules stabilized in the interlayer space of LDH retain their chemical and biological integrity. If necessary, LDH, as a reservoir, can be intentionally removed by dissolving it in an acidic media. On the other hand, interlayer biomolecules can also be deintercalated via ion-exchange reaction in an electrolyte which offers a way of recovering the encapsulated biomolecules. In addition, we also found that the hydroxide layers could protect the

intercalated DNA very efficiently from DNase degradation, and also tailor the DNA molecule with an appropriate size or length depending on the particle size of LDH. It is, therefore, concluded that the inorganic LDH can act as a good host lattice for a gene reservoir or carrier.