International Research Center for Elements Science
- Advanced Solid State Chemistry -

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Scope of Research

Novel inorganic materials that have new, useful or exotic features such as superconductivity, ferromagnetism and quantum spin ground state are synthesized by novel methods. Recent topics are:

- High-T_c superconducting copper oxides with higher T_c or J_c.
- Perovskite-based compounds with unusual magnetic and electronic properties.
- Low-dimensional spin system showing dramatic quantum effects.

Research Activities (Year 2003)

Presentations

Ligand Holes: $SrFeO_3$ and $(Ca,Na)_2CuO_2Cl_2$, Takano M, International Workshop on Strongly Correlated Transition Metal Compounds, 4 - 7, August.

High Pressure Synthesis and Crystal Structure of Perovskite $BiNiO_3$ and Effects of A-Site Substitution, Ishiwata S, Azuma M, Kato K, Nishibori E, Vacate M, Skated M, Takano M, Joint 19th AIRAPT-41st EHPRG International Conference on High Pressure Science and Technology, 7 - 11, August.

High-pressure Synthesis and Physical Properties of Bi-Contained Transition Metal Oxides $BiCrO_3$, and $BiCoO_3$, Niitaka S, Azuma M, Takano M, Nishibori E, Takata M, Sakata M, Joint 19th AIRAPT-41st EHPRG International Conference on High Pressure Science and Technology, 7 - 11, August.

Single Crustal Growth of $PrNiO_3$ Perovskite at 4.5 GPa and the Study of its Metal-Insulator Transition, Saito T, Azuma M, Nishibori E, Takata M, Sakata M, Nakayama N, Arima T, Kimura T , Urano C, Takano M, Joint 19th AIRAPT-41st EHPRG International Conference on High Pressure Science and Technology, 7 - 11, August.

Blue-Light Emission from $SrTiO_3$

Blue-light emission was observed from $SrTiO_3$ single crystal with oxygen deficiencies caused by Ar^+ ion beam irradiation. Emission intensity increased with the increase of Ar^+ irradiation time. New electronic state (E=2.8eV) is generated by the Ar^+ irradiation. Light emission of $SrTiO_3$ might be caused by the excitonic mechanism. Light emission devices with short wave length and high power using Ti^{3+} containing perovskite are expected in the future.

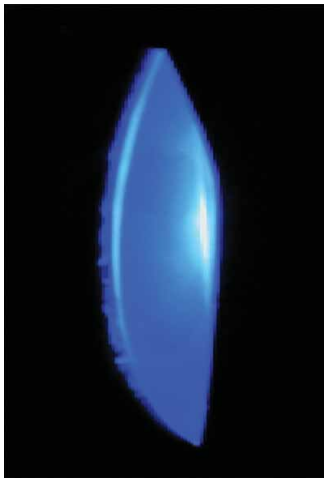

Figure 1. Cathode luminescence of $SrTiO_3$.

Cubic FePt nanoparticles

Colloidal nanoparticles are promising candidates in a wide range of technological applications and have been the subject of numerous works. Although synthetic works have focused on the preparation of monodisperse spherical nanoparticles with a controlled size, physical and chemical properties are mostly dependent not only on size but also on shape. We have succeeded in synthesizing monodisperse FePt nanoparticles with a *cubic* shape for the first time based on a simple organic-phase reaction. 2-D array of the present cubic nanoparticles can be a promising candidate for a "bit per particle" data storage media.

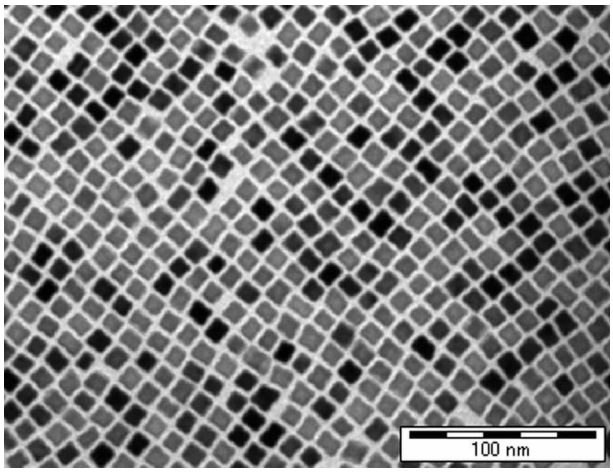

Figure 2. FePt nanoparticles with a cubic shape.

Grants

Takano M, Development of 3d transition-metal oxides with oxygen p holes. Grant-in-Aid for Scientific Research (A) (2), 1 April 2002 - 31 March 2005.

Terashima T, Electric field induced superconductivity in the FET devices using ultrathin $SrTiO_3$ single-crystal substrate with high dielectric constant. Grant-in-Aid for Scientific Research (B) (2), 1 April 2002 - 31 March 2004.

Terashima T, Preparation and properties of epitaxial thin films of oxides containing transition-metal ions in unusually high-valence states, Priority Area Grants from the Ministry of Education, Science, Culture and Sport of Japan, 1 April 2000 - 31 March 2004.

Azuma M, Exploration of photo-functions in strongly correlated electron systems of transition metal oxides, PRESTO, 1 December 2001 - 31 November 2004.

Awards

Takano M, 2002 JSPM Award for Distinguished Achievements in Research, Discovery of Novel 3d-Transition Metal Oxide: High-Pressure Synthesis, The Japan Society of Powder and Powder Metallurgy, 21 May 2003.

Ishiwata S, The ICR Award for Students, High Pressure Synthesis and Crystal Structure of Perovskite $BiNiO_3$, and Suppression of A-site Charge Disproportionation by La-substitution, ICR, 5 December 2003.