Chemistry and Physics of 3d Transition Metal Oxides Equipped with Deep 3d Levels: Search for New Materials and New Functions

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【Outline of survey】

Oxides containing 3d transition metals like titanium (Ti), iron (Fe), and copper (Cu), which are all known to a wide public, have been practically used as condensers, catalysts, magnetic recording materials, high-T_c superconducting cables, and so on. What we aim at in the present project is to further increase the variety of these oxides and, thereby, discover new properties and functions. Such research activities often encounter a difficulty caused by manybody nature: It is practically impossible to predict exactly what kind of material we can obtain and what kind of properties it ehxibits. For the sake of lightening we utilize various preparative techniques in this single project.

As the atomic number increases and as the valence becomes high the 3d levels of a transition metal become deep. As a result, the surrounding oxide ions are more or less oxidized. In other words, the contribution of ligands to chemical and physical properties may be important and specific in these oxides. To dig out the specificity is an important subject of this project.

【Expected results】

・Innovation of synthetic techniques: Innovation of synthetic techniques no doubt leads us to new materials. In the present project specialists having different techniques participate. Their cooperative interactions will yield such innovations.

・Discovery of new materials, new properties and new functions: Digging up of such specific anionic contributions as mentioned above has not been a main subject in the field of solid state chemistry and physics. We will extend our interest to nitrides also because an nitride ion, N^{3-}, is expected to be more easily oxidized than O^{2-}. Magnetic, electrical, and optical properties will be of our interest as well as ionic conductivity.

【References by the principal researcher】

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2: Oxygen-Holes Creating Different Electronic Phases in Fe^{4+}-Oxides: Successful Growth of Single Crystalline Films of $SrFeO_3$ and Related Perovskites at Low Oxygen Pressure, *J. Mater. Chem.*, **11** (2001) 2235-2237. N. Hayashi, T. Terashima and M. Takano

【Term of project】 FY 2005 - 2009

【Budget allocation】 81,700,000 yen

【Homepage address】 http://msk2.kuicr.kyoto-u.ac.jp/home.html