Title of Project: Novel Nano-electronics based on Strongly Correlated Oxides.

Hidekazu Tanaka
( Osaka University, The Institute of Scientific and Industrial Research, Professor)

Research Area: Engineering
Keyword: New functional materials, Strongly-correlated system, Heterostructure, Formation/Control of nanostructure, Spintronics

Purpose and Background of the Research
Transition metal oxides, having strongly correlated electron systems, show unusually drastic phase transitions (Mott transitions), including ferromagnetism, superconductivity, and others. If it were possible to effectively control their carrier by electric field or light as semiconductor industry, novel functional electronics could be created, because their functionalities originate from electron-electron interaction. In this project, I construct heterostructured and nano-heterostructured correlated oxides to establish the method to effectively control their electron-correlation.

Research Methods
As candidates, Fe oxide exhibits ferro/ferri-magnetism with very high Curie temperature and the strongest electron correlation, and V oxide shows huge metal-insulator transition. For these materials, following methods are conducted,
(1) Fabrication of heterostructured devices (field effect transistor and diode) by Laser-Molecular Beam Epitaxy and control of their physical properties by applying bias field and light.
(2) Direct investigation of interfacial electronic/spin structures by spectroscopy using synchrotron radiation facility such as SPring-8, to elucidate their mechanism.
(3) Creation of nano- heterostructured devices using nano-fabrication technique originally developed.

Expected Research Achievements and Scientific Significance
The target materials have excellent functionalities for next generation nonvolatile memories and/or sensors detecting environmental surroundings, closely connected to our life. Novel dynamical tunable method on these functionalities will bring new application fields for ICT society and safe/secure society.

Publications Relevant to the Project

Term of Project: FY2009-2013
Budget Allocation: 75,800 Thousand Yen

Homepage Address and Other Contact Information
http://www.sanken.osaka-u.ac.jp/labs/bis/h-tanaka@sanken.osaka-u.ac.jp