【Grant-in-Aid for Young Scientists(S)】
Science and Engineering (Engineering I)

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

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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.

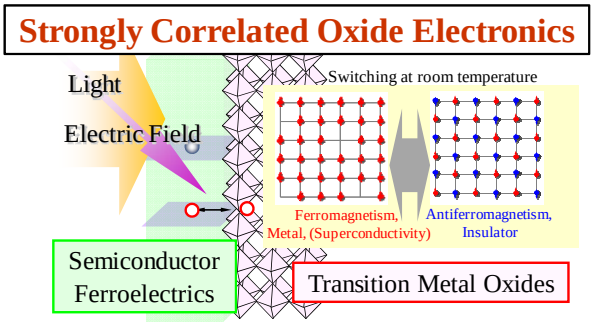

Fig. 1 Correlated oxide heterostructured device

【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. at room temperature. 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.

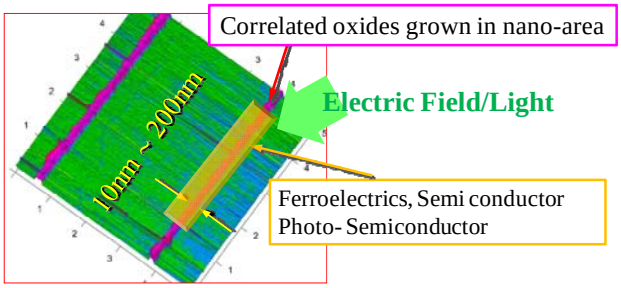

Fig. 2 Nano- heterostructured device

【 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】

・ “Epitaxial transition metal oxide nano-structures fabricated by a combination of AFM lithography and molybdenum lift-off”, H. Tanaka *et al*, Adv. Mater, **20** (2008) 909-913

・“Electronic structures of $Fe_{3-x}M_xO_4$ (M=Mn,Zn) spinel oxide thin films investigated by X-ray photoemission spectroscopy and X-ray magnetic circular dichroism”, H. Tanaka *et al* Phys. Rev. B, **76** (2007) 205108

・ “Giant Electric Field Modulation of Double Exchange Ferromagnetism at Room Temperature in The Perovskite Manganite/ Titanate p-n Junction” H. Tanaka *et al*, Phys. Rev. Lett., **88** (2002) 027204

【Term of Project】 FY2009-2013

【Budget Allocation】 75,800 Thousand Yen

【 Homepage Address and Other Contact Information】

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