Magneto-Optical Spectra of Composition-Spread Thin Films of Transition-Metal Oxides

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Research Topics

- Magneto-optical properties of composition-spread thin films of transition-metal oxides
- Optical properties of the epitaxial thin films assessed using optical microscopy
- Investigation of thin films to innovate new functional materials

Research Seeds

Continuous estimation of magneto-optical properties of composition-spread thin films

To innovate new functional materials, the combinatorial approach with use of composition-spread films is promising because it enables coherent and systematic investigation of the properties of materials with continuously varying composition (Fig. 1).

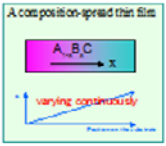

Fig.1

The solid solution system of $Sr_{1-x}Ca_xRuO_3$ undergoes a change of magnetism from ferromagnetic ($SrRuO_3$) to paramagnetic ($CaRuO_3$) with doping of x despite their similar lattice and electronic structures. To investigate the magnetic criticality of $Sr_{1-x}Ca_xRuO_3$, the combinatorial synthesis of the composition (x)-spread thin film is most promising. We used magneto-optical (MO) Kerr spectroscopy employing polarization modulation to examine systematic characteristics of magnetic properties. In Fig. 2 the MO spectra of Kerr rotation (θ) and ellipticity (η) are shown for $Sr_{1-x}Ca_xRuO_3$ with varying x at 10K. Contour maps in the plane of temperature vs composition x as constructed by the magnitudes of θ at 1.71 eV are also presented in Fig. 2. The x and temperature dependence of the Kerr rotation spectra have revealed systematic and continuous change of magnetization attributable to variation of band exchange splitting. The continuous transition from the ferromagnetic to the paramagnetic state at low temperatures suggests the quantum critical point of around x≈ 0.5 in this epitaxial thin film sample. Our results confirm the MO technique as a useful tool for efficient and systematic investigation of the magnetic state of the combinatorially prepared materials.

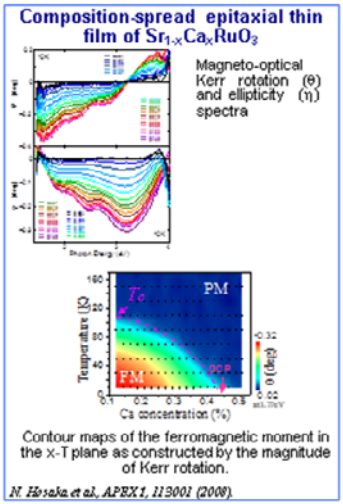

Fig.2

[Reference] H. Koinuma and M. Kawasaki, Combinatorial Technology, Maruzen (2004) .

Related Technology

- Magneto-optical Kerr spectroscopy
- Optical microscopy