

## THE SUMMARY OF Ph. D. DISSERTATION

Major Fundamental Science and Technology		SURNAME, Firstname  HIRANO, Yukiko
Title  Magnetoelastic effects in rare-earth compounds $RVO_4$ and $RPO_4$		
Abstract  <p>The wave functions of the rare-earth ions in <math>RVO_4</math> and <math>RPO_4</math> are mainly determined by the crystal-field imposed on the <math>4f</math> electrons. The variation of the crystal-field caused by strains corresponds to the one ion magnetoelastic coupling which describes the coupling between <math>4f</math> electronic states and deformations of the lattice. This coupling leads to various characteristic features of the crystalline lattice.</p> <p>X-ray diffraction measurements performed on <math>ErVO_4</math> and <math>ErPO_4</math> revealed anisotropic thermal expansion. It has been known that, in the cases of many <math>RVO_4</math> and <math>RPO_4</math>, the anisotropic thermal expansion can be explained in terms of the quadrupolar interaction of the <math>4f</math> electronic states with the lattice. In contrast, the contribution from the sixth-order interaction was found to be essential in order to explain the thermal-expansion anomalies found in <math>ErVO_4</math> and <math>ErPO_4</math>. From detailed analysis of the crystal-field, it was concluded that the sixth-order term of the crystal-field Hamiltonian has a major effect on energy levels of Er ions.</p> <p>As a result of the magnetoelastic coupling, a cooperative Jahn-Teller phase transition involving a distortion of <math>B_{2g}</math> symmetry occurs in <math>TbVO_4</math>. The Jahn-Teller transition of the same type does not occur in <math>TbPO_4</math>. The Jahn-Teller transitions were observed for mixed crystals <math>TbV_{1-x}P_xO_4</math> (<math>0 \leq x \leq 0.32</math>) by X-ray diffraction techniques. A striking reduction in the transition temperature with increasing P concentration was observed. This reduction is a result of lowering of the local symmetry of the crystal-field due to random distributions of V and P atoms. The results of the diffuse scattering measurements performed on the <math>x = 0.32</math> crystal indicated the existence of local strains.</p> <p>The present analysis of the observed magnetoelastic effects should shed light on the fundamental mechanism of orbital ordering in <math>d</math>- and <math>f</math>- electron compounds.</p>		