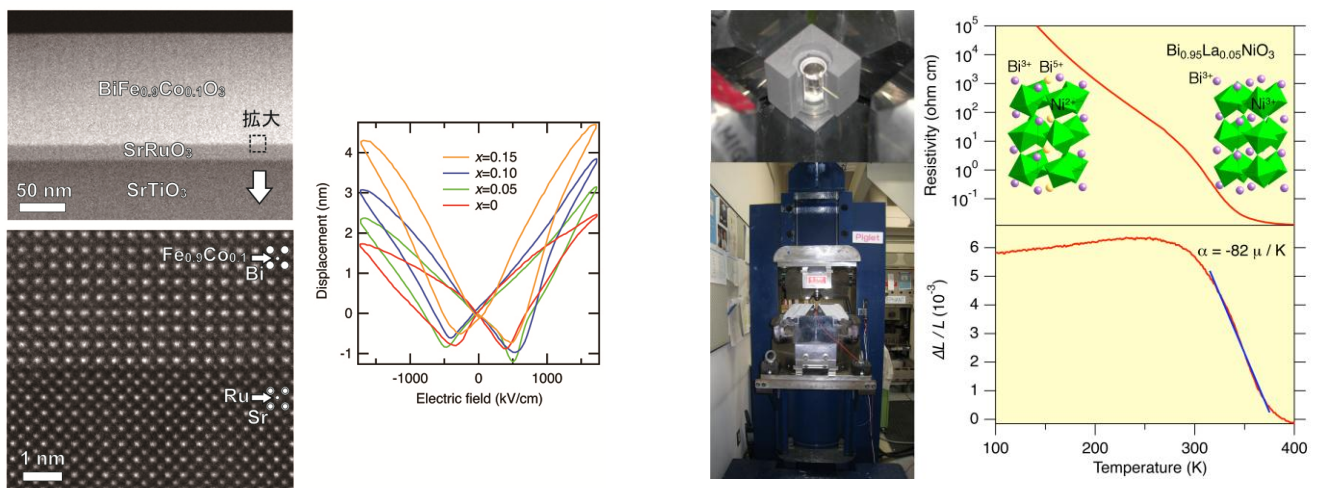


## Discovery of new functional oxides and clarification of the origin of the function

Transition metal oxides exhibit various useful functions such as magnetism, ferroelectricity and superconductivity. We realize new functional oxides such as ferromagnetic ferroelectrics, lead-free piezoelectrics and negative thermal expansion materials by means of state-of-art synthesis techniques like high-pressure synthesis used for diamond synthesis, thin-film fabrication on single crystalline substrates and hydrothermal synthesis.

We are also interested in low dimensional antiferromagnets where spins form special lattices such as ladder and honeycomb. Above mentioned functions are closely related to their crystal structures. We detect the tiny structural change accompanied with the occurrence of functions by using synchrotron X-ray and neutron beams. Such obtained information is applied to the design and the synthesis of further new materials.



Scanning transmission electron microscope image and displacement-electric field ( $d-E$ ) curves of  $\text{BiFe}_{1-x}\text{Co}_x\text{O}_3$  thin films. The piezoelectric constant  $d_{33}$  estimated from the slope of the  $d-E$  curve increases as the content of Co increases.

$\text{Bi}_{0.95}\text{La}_{0.05}\text{NiO}_3$  which shows a charge transfer between Bi and Ni on heating. Metallization and negative thermal expansion three times as large as the existing material takes place reflecting the oxidation from  $\text{Ni}^{2+}$  to  $\text{Ni}^{3+}$