Scientists find new set of multiferroic materials

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(PhysOrg.com) -- The trail to a new multiferroic started with the theories of a U.S. Department of Energy's Argonne National Laboratory scientist and ended with a multidisciplinary collaboration that created a material with potential impact on next generation electronics.

Argonne scientist Craig Fennie's principles of microscopic materials design predicted that the high pressure form of $FeTiO_3$ would have both weak ferromagnetism and ferroelectric polarization, an unusual combination in a single material.

"We were able to take the theory and, through targeted synthesis and measurement, prove that $FeTiO_3$ has both weak ferromagnetism and ferroelectricity, just as Craig predicted," Argonne scientist John Mitchell said. "Success in this materials design and discovery project would not have been possible without a collaborative team involving several disciplines and talents from across the lab and indeed the country."

Scientists from Argonne's Materials Science division and Center for Nanoscale Materials along with scientists from Pennsylvania State University, University of Chicago and Cornell University used piezoresponse force microscopy, optical second harmonic generation and magnetometry to show ferroelectricity at and below room temperature and weak ferromagnetism below 120 Kelvin for polycrystalline $FeTiO_3$ synthesized at high pressure.

Multiferroic materials show both magnetism and polar order, which are seemingly contradictory properties. Magnetic ferroelectrics may have applications in memory, sensors, actuators and other multifunctional devices by acting as magnetic switches when their electric fields are reversed.

This project was recently published in *Physical Review Letters* and will be featured in the upcoming Advanced Photon Source annual report.

Provided by Argonne National Laboratory (news : web)