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Magnetoelectric measurements of multiferroic thin film materials using microwave microscopy ICHIRO TAKEUCHI, University of Maryland, CHEN GAO, MAKOTO MURAKAMI, KAO-SHUO CHANG, UNIVERSITY OF MARYLAND COLLABORATION — We have developed a technique to quantitatively measure the magnetoelectric (ME) coupling effect in multiferroic materials using microwave microscopy operating at 1 GHz. The technique is used to measure the piezovoltage induced by an external magnetic field through the non-linear dielectric constant. The unique tip geometry of the microscope allows measurement of the ME coupling from a sample region as small as 1 micron cube without the use of a bottom electrode. AC magnetic field up to $\sim$ 10 Oe is used. We have demonstrated the measurement on different types of multiferroic films. In particular, $PbTiO_3$-$CoFe_2O_4$ nanocomposite thin films consisting of nanograins of $PbTiO_3$ embedded in the matrix $CoFe_2O_4$ was found to exhibit enhanced ferroelectric properties and robust ferromagnetism. The ME coefficient as large as 4 V/cmOe was observed in the nanocomposites at room temperature. Enhancement in the ME effect due to the mechanical resonance of the substrate was observed at $\sim$100 KHz.

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