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Ferroelectricity of Bi-doped ZnO Films Probed by Scanning Probe Microscopy

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We present ferroelectricity of Bi-doped ZnO film probed by piezoresponse force microscopy (PFM), which is one of the Scanning Probe Microscopy techniques. Perovskite ferroelectrics are limited to integration of devices into semiconductor microcircuitry due to hard adjusting their lattice structure to the semiconductor materials. Transition metal doped ZnO film is one of the candidate materials for replacing the perovskite ferroelectrics. In this study, ferroelectric characteristics of the Bi-doped ZnO grown by pulsed laser deposition were probed by PFM. The polarization switching and patterning of the ZnO films were performed by applying DC bias voltage between the AFM tips and the films with varying voltages and polarity. The PFM contrast before and after patterning showed clearly polarization switching for a specific concentration of Bi atoms. In addition, the patterned regions with nanoscale show clearly the local piezoresponse hysteresis loop. The spontaneous polarization of the ZnO film is estimated from the local piezoresponse based on the comparison with LiNbO3 single crystals.

Keywords: Bi, ZnO, Ferroelectricity, Piezoresponse force microscopy