**Recording Medium Design Aiming at Realizing Ferroelectric Probe Data Storage**

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Ferroelectric probe data storage is a novel data storage method, which uses ferroelectric materials as a recording layer. In this method, digital data bits are recorded by nano-scaled polarization reversal. Extremely small domain dots (diameter of less than 10 nm) can be formed using ferroelectric thin films and nanoscale probe tip. Up to now, a domain dot array with an areal recording density of 4 Tbit/inch2 has been written on a single-crystal LiTaO3 recording medium to demonstrate its potential. This novel method, however, has a problem of low reading speed. Up to now, we have reported 3.7 Mbps readout demonstration using thin-film PZT recording media. Although this achieved readout speed is much higher than other probe data storage techniques, there is a significant gap between the current and the required specifications.

To overcome this problem, a novel ferroelectric recording medium with large nonlinear permittivity is required, because this data storage method uses the nonlinear dielectric response induced by small-amplitude ac bias to detect the bit data recorded in the form of polarization direction. Thus, we examined nonlinear permittivity based on phenomenological theory from the viewpoint of data storage application. We revealed that Curie-point control is one of the key techniques in material design for our application because nonlinear permittivity increases precipitously with approaching to the Curie temperature as with linear permittivity and piezoelectric constants. On the other hand, we also revealed that there is a trade-off relationship between nonlinear permittivity and polarization stability. To avoid this undesirable situation in data storage application, pinning-site control will also be important. Additionally, we also propose to employ a double-layer structure in the ferroelectric recording media for further improvement.

**Keywords :** Probe data storage, Nonlinear permittivity, Phenomenological theory, LiTaO3