

마이크로파 대역에서  $\text{PbTiO}_3$  박막의 Dipolar Relaxation에 대한  
박막 두께의 효과

The Effects of Film Thickness on the Dipolar Relaxation of  $\text{PbTiO}_3$  Thin Films in  
the Microwave-Frequency Range

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The effects of film thickness on the dipolar relaxation of ferroelectric  $\text{PbTiO}_3$  films were investigated in the microwave-frequency range. The dielectric constants ( $\epsilon$ ) and the dielectric losses ( $\tan \delta$ ) were successfully measured up to 30 GHz using interdigital capacitors. The  $\text{PbTiO}_3$  thin films were deposited on the quartz substrate at room temperature and post-annealed in oxygen atmosphere. As the film thickness increased, its grain size and tetragonality were enhanced. And the dipolar relaxation behavior began to appear in the thin films with approximately 20 nm thickness, since ferroelectric domains could not be formed in small grains. The observed relaxation frequency (above 10 GHz) was higher than the previous values reported in bulk ceramics. It can be correlated with the extremely small domain size of the thin films as shown by TEM. And, the Rayleigh constant [1] from domain wall motions was also investigated by LCR meter at 100 kHz.

Reference : [1] *D. V. Taylor, and D. Damjanovic, J. Appl. Phys.* 82, 1973 (1997)