

High Field Dielectric Response in κ -Ga₂O₃

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κ -Ga₂O₃ has been predicted to be a potential ferroelectric material. In this work, undoped Ga₂O₃ films were grown by either plasma-enhanced atomic layer deposition (PEALD) or metal organic chemical vapor deposition (MOCVD) on platinumized sapphire substrates. 50 nm thick PEALD films with a mixture of κ -Ga₂O₃ and β -Ga₂O₃ had a relative permittivity of similar to 27, a loss tangent below 2%, and high electrical resistivity up to similar to 1.5 MV/cm. 700 nm thick MOCVD films with predominantly the κ -Ga₂O₃ phase had relative permittivities of similar to 18 and a loss tangent of 1% at 10 kHz. Neither film showed compelling evidence for ferroelectricity measured at fields up to 1.5 MV/cm, even after hundreds of cycles. Piezoresponse force microscopy measurements on bare κ -Ga₂O₃ showed a finite piezoelectric response that could not be reoriented for electric fields up to 1.33 MV/cm.