

Excimer Laser Assisted Re-oxidation of BaTiO₃ Thin Films on Ni Metal Foils

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Excimer laser assisted re-oxidation for reduced, crystallized BaTiO₃ thin films on Ni-foils was investigated. It was found that the BaTiO₃ can be re-oxidized at an oxygen partial pressure of ~50 mTorr and substrate temperature of 350 °C without forming a NiO_x interface layer between the film and base metal foil. The dielectric permittivity of re-oxidized films was >1000 with loss tangent values <2% at 100 Hz, 30 mV_{rms} excitation signal. Electron Energy Loss Spectroscopy indicated that BaTiO₃ thin films can be re-oxidized to an oxygen stoichiometry close to ~3 (e.g., stoichiometric). High resolution cross sectional transmission electron microscopy showed no evidence of NiO_x formation between the BaTiO₃ and the Ni foil upon excimer laser re-oxidation. Spectroscopic ellipsometry studies on laser re-oxidized [001]_C and [111]_C BaTiO₃ single crystals indicate that the re-oxidation of BaTiO₃ single crystals is augmented by photo-excitation of the ozone, as well as laser pulse induced temperature and local stress gradients.