Structure dynamics of strongly reduced epitaxial $BaTiO_{3-x}$ studied by Raman Scattering

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Abstract: Raman scattering technique was used to study structure dynamics of strongly reduced epitaxial barium titanate thin films grown on MgO (100) substrates by laser molecular beam epitaxy under different oxygen pressures from 10^{-2} Pa to 10^{-5} Pa. X-ray diffraction and asymmetric rocking curves indicate that lattice parameters *c* and *c*/*a* ratio increase, and *a* slightly decreases with decreasing oxygen pressure, indicating increased lattice volume of $BaTiO_{3-x}$ thin film. Raman spectra confirm that $BaTiO_{3-x}$ thin films are in tetragonal phase with some deviated features, which maybe origin from tensile strain at film-substrate interface due to lattice parameter mismatch. Moreover two weak peaks in Raman spectra of $BaTiO_{2.52}$ thin film grown under 3.0×10^{-5} Pa may be induced by second-order two-phonon processes. Raman peaks shift towards lower frequency with decreasing oxygen pressure during deposition, suggesting a decreases of the stress in $BaTiO_{3-x}$ thin films. In the meantime, Raman peaks become broaden, which may be attributed to higher degree of structural disorder in strongly reduced $BaTiO_{3-x}$ lattice structure.

Key words: Films; Defects; Spectroscopy; X-ray methods; Optical properties; $BaTiO_3$.

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