

A Proposal of New Buffer Layer for Depositing (110)-oriented Perovskite Thin Films on (111)Pt/SiO₂/Si Substrates

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Y doped BaCeO₃ (BCYO) and Y doped SrZrO₃ (SZYO) thin films of perovskite oxides were deposited on (111)Pt/SiO₂/(100)Si [abbreviated as (111)Pt/Si] substrates by the RF-magnetron sputtering method. X-ray diffraction appeared that the BCYO and SZYO thin films were highly (110)-oriented in the normal direction of the substrates but randomly oriented in plane.

To investigate more precise crystallographic relationship between (110)SZYO and (111)Pt, SZYO thin film of perovskite-type oxides with (110) orientation was deposited on (111)Pt/(111)SrTiO₃ (STO) single crystal substrates. X-ray diffraction patterns and transmission electron microscopy analysis showed that the SZYO thin film was epitaxially grown and composed of columnar grains with 10–20 nm-in width and rotated about 10° in-plane. The pole figure scan showed (110)-diffraction peaks with six-fold symmetry at azimuth angle, i.e. psi angle, of 60° together with the center one. These results indicate that the film is epitaxially grown with three domains.

Finally, we deposited SrRuO₃ (SRO) thin films, a typical conductive perovskite-type oxide, on the polycrystalline (110)BCYO and (110)SZYO fabricated on (111)Pt/Si and found the deposited SRO thin film was highly (110)-oriented. We believe these BCYO and SZYO films can be used for depositing (110)-oriented functional perovskites, e.g. (Ba,Sr)TiO₃ and Pb(Zr,Ti)O₃, on (111)Pt/Si substrates.

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