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X-ray photoelectron spectroscopy studies of ferroelectric PZT thin films prepared by metalorganic chemical vapor deposition method

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Recently, ferroelectric thin films have attracted great interest because of its applications for ferroelectric random-access memories (FERAMs) and dynamic random-access memories (DRAMs). In order to obtain ferroelectric thin films, various thin film techniques, such as the sputtering, evaporation, chemical vapor deposition, and sol-gel methods, have been reported.

Thin films of Lead Zirconate Titanate, $\text{Pb}(\text{Zr}, \text{Ti})\text{O}_3$ (PZT), were grown on $\text{Pt}/\text{SiO}_2/\text{Si}(100)$ by metalorganic chemical vapor deposition (MOCVD), using $\text{Pb}(\text{tmhd})_2$, $\text{Ti}(\text{OC}_3\text{H}_7)_4$, $\text{Zr}(\text{tmhd})_4$ and O_2 . These films were analyzed with X-ray photoelectron spectroscopy (XPS) for determining the chemical composition and chemical bonding characteristics. It was found that the chemical compositions and chemical bondings of ions in the near surface are different from those in the bulk region of the films. The oxidation state of titanium ions in the bulk region is reduced in comparison to that of titanium ions in the surface region of the films and lead enrichment in the near surface region was also observed. Lead ion in the surface region exists mainly in the form of PbO_{ads} (oxygen-chemisorbed lead), but lead ion in the bulk region exists in the form of mixture of PbO and PbTiO_3 . More details on the chemical bonding characteristics of the ions in PZT thin films will be discussed.

References

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