Low Temperature Preparation of Ferroelectric (PZT) Thin Films by New Sputter Deposition Mode and Investigation of Its Mechanisms

1998 Fiscal Year Final Research Report Summary

Low Temperature Preparation of Ferroelectric (PZT) Thin Films by New Sputter Deposition Mode and Investigation of Its Mechanisms

Research Project

Project/Area Number

09650349

Research Category

Grant-in-Aid for Scientific Research (C)

Allocation Type

Single-year Grants

Section

一般

Research Field

Electronic materials/Electric materials

Research Institution

Kanazawa University

Principal Investigator

HATA Tomonobu Kanazawa University, Faculty of Engineering, Professor, 工学部, 教授 (50019767)

Project Period (FY)

1997 – 1998

Keywords

Sputtering / PZT Thin Films / Metallic Mode / Oxide Mode / Isotope Oxygen / ZrTi Target / Metal-Oxide Combined Target

Research Abstract

Origin of oxygens in PZT (Pb(Zr, Ti)O_3) films prepared using isotope oxygen (18O_2) was investigated by analyzing the mass of oxygens in the films by SIMS technique. For a film prepared by metallic mode it was found for the first time that 90% oxygen in the film was from PbO and the rest 10% from oxygen gas. Thus PbO is the main oxygen source. While, for oxide mode 30% oxygen came from PbO, consequently, oxygen gas was the main oxygen source.
Quantitatively investigating Pb ratio to Zr+Ti in targets, it was found that perovskite films were intended to grow when the ratio was more than 3. This result is recognized that perovskite films grew when oxygen was supplied so as to just satisfy the stoichiometry of PZT.PbO is not necessary to just

supplement its deficiency due to high volatility of Pb. This is a novel view point.
Finally based on results a design method for target of quasi-metallic mode sputter deposition is proposed.

Research Products (12 results)

All | Other

All | Publications (12 results)

[Publications] T.Hata et al.: "Proposal of new mixture target for PZT thin films by reactive sputtering" Vacuum. 51. 665-671 (1998)

[Publications] K.Sasaki et al.: "Origin of oxygen in Pb(ZrTi)O_3 films Prepared by Metal Oxide Combined Target" Vacuum. 51. 661-664 (1998)

[Publications] 佐々木 他: "金属モードスパッタリングによるエピタキシャル高・強誘電体薄膜の作製" 電子情報通信学会技術研究報告. ED97-214. 17-22 (1998)

[Publications] K.Sasaki et al.: "Origin of oxygen in PZT Films Prepared by Metal-Oxide Combined Target" Proc.of 4th International Symposium on Spattering and plasma process. 607-612 (1997)

[Publications] T.Hata et al.: "Propose of New Target for PZT Thin Films by Reactive Spattering" Proc.of 4th International Symposium on Spattering and plasma process. 617-622 (1997)

[Publications] T.Hata et al.: "Propse of New Mixture Target for Low Terperature and High Rate Deposition of PZT thin Films" Exterded Abstract of Solid State Devices and Materials. 36-37 (1997)

[Publications] Je-Deok Kim, Kimihiro Sasaki and Tomonobu Hata: "Preparation and Properties of Pb (Zr, Ti) O3 Thin Films on Ir Electrode Using a Apparatus" Proc.of 5th International Symposium on Sputtering and Plasma Process. (to be published, 1999).

[Publications] K.Sasaki, W.X.Zhang and T.Hata: "Origin of oxygen in Pb (Zr, Ti) O_3 films prepared by metal-oxide combined target" Vacuum. Vol.51/4. 661-664 (1998)

[Publications] T.Hata, S.Kawagoe, W.Zhang, K.Sasaki, Y.Yoshioka: "Proposal of new mixture target for PZT thin films by reactive sputtering" Vacuum. Vol.51/4. 665-671 (1998)

[Publications] T.Hata, W.Zhang, S.Kawagoe and K.Sasaki: "Propose of New Mixture Target for Low Temperature and High Rate Deposition of PZT Thin Films by Reactive Sputtering" Ext.Abs.of SSDM'97. 36-37 (1997)

[Publications] T.Hata W.Zhang and K.Sasaki: "Propose of New Target for PZT Thin Films by Reactive Sputtering" Proc.of 4th ISSP. 617-622 (1997)

[Publications] K.Sasaki, W.Zhang, S.Kawagoe and T.Hata: "Origin of Oxygen in PZT Films Prepared by Metal-Oxide Combined Target" Proc.of 4th ISSP. 607-612 (1997)

URL: https://kaken.nii.ac.jp/report/KAKENHI-PROJECT-09650349/096503491998kenkyu_seika_hokoku_

Published: 1999-12-07