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## **1. Main Research Results**

- 1) Clarification of the dielectric tunable properties of self-assembled composite thin films.  
The dielectric tunable properties of self-assembled composite thin films consisting of ferroelectric BaTiO<sub>3</sub> and low-permittivity dielectric CeO<sub>2</sub> have been characterized.
- 2) Development of strain-induced ferroelectric materials.  
The correlation between ferroelectric and antiferrodistortive phase transitions in strained SrTiO<sub>3</sub> films was studied.
- 3) Structural analysis of a single crystal nanowire by synchrotron x-ray diffraction.  
The structural analysis of a PX-phase PbTiO<sub>3</sub> single crystal nanowire was performed by x-ray diffraction using the synchrotron micro x-ray beam.

## **2. List of Publication(original article, comment/book)**

### **1) Original Paper**

- (1) A.Noeth, T.Yamada, A.K.Tagantsev, and N.Setter: "Electrical Tuning of dc Bias Induced Acoustic Resonances in Paraelectric Films", *Journal of Applied Physics* 104, 094102 (2008).
- (2) V.O.Sherman, P.Czarnecki, I.D.Wolf, T.Yamada, N.Setter, B.Malic, M.Vukadinovic, and M.Kosec: "Reliability Study of Tunable Ferroelectric Capacitors", *Journal of Applied Physics* 104, 064104 (2008).
- (3) H.Funakubo, S.Okaura, M.Suzuki, H.Uchida, S.Koda, R.Ikariyama, and T.Yamada: "Low Strain Sensitivity of the Dielectric Property of Pyrochlore Bi-Zn-Nb-O Films", *Applied Physics Letters* 92, 182901 (2008).
- (4) T.Fujisawa, H.Nakaki, R.Ikariyama, T.Yamada, and H.Funakubo: "Thick Epitaxial Pb(Zr<sub>0.35</sub>Ti<sub>0.65</sub>)O<sub>3</sub> Films Grown on (100)CaF<sub>2</sub> Substrates with Polar-axis-orientation", *Applied Physics Express* 1, 085001 (2008).
- (5) S.Yasui, H.Naganuma, S.Okamura, K.Nishida, T.Yamamoto, T.Iijima, M.Azuma, H.Morioka, K.Saito, M.Ishikawa, T.Yamada, and H.Funakubo: "Crystal Structure and Electrical Properties of {100}-oriented Epitaxial BiCoO<sub>3</sub>-BiFeO<sub>3</sub> Films Grown by Metal Organic Chemical Vapor Deposition", *Japanese Journal of Applied Physics* 47, 7582-7585 (2008).
- (6) G.Deng, T.Yamada, and P.Muralt: "Physical Origin of Colossal Dielectric Constant in CaCu<sub>3</sub>Ti<sub>4</sub>O<sub>12</sub> Thin Film by Pulsed Laser Deposition", *Mater. Res. Soc. Symp. Proc.*, 1073E, 1073-H05-04 (2008).
- (7) S.Utsugi, T.Fujisawa, R.Ikariyama, S.Yasui, H.Nakaki, T.Yamada, M.Ishikawa, M.Matsushima, H.Morioka, and H.Funakubo: "Domain Structure of (100)/(001)-oriented Epitaxial PbTiO<sub>3</sub> Thick Films with Various Volume Fraction of (001) Orientation Grown by Metal Organic Chemical Vapor Deposition", *Applied Physics Letters* 94, 052906 (2009).
- (8) M.Ishikawa, S.Yasui, S.Utsugi, T.Fujisawa, T.Yamada, T.Morita, M.Kurosawa, and H.Funakubo:

- “Growth of Epitaxial Potassium Niobate Film on (100)SrRuO<sub>3</sub>/(100)SrTiO<sub>3</sub> by Hydrothermal Method and their Electromechanical Properties”, *Mater. Res. Soc. Symp. Proc.*, 1139, 1139-GG03-52 (2009).
- (9) D.Nuzhnyy, J.Petzelt, S.Kamba, T.Yamada, M.Tyunina, A.K.Tagantsev, J.Levoska, and N.Setter: “Polar Phonons in Some Compressively Stressed Epitaxial and Polycrystalline SrTiO<sub>3</sub> Thin Films”, *Journal of Electroceramics* (2008) in press [online: DOI 10.1007/s10832-008-9494-2].
- (10) A.Noeth, T.Yamada, A.K.Tagantsev, and N.Setter: “Effect of Mechanical Loading on the Tuning of Acoustic Resonances in Ba<sub>x</sub>Sr<sub>1-x</sub>TiO<sub>3</sub> Thin Films”, *Journal of Electroceramics* (2009) in press [online: DOI 10.1007/s10832-009-9564-0].
- (11) T.Yamada, C.S.Sandu, V.O.Sherman, A.Noeth, P.Muralt, A.K.Tagantsev, and N.Setter: “Self-Assembled Perovskite-Fluorite Oblique Nanostructures for Adaptive (Tunable) Electronics”, *Advanced Materials* (2009) in press [online: DOI 10.1002/adma.200800253].
- (12) S.Ito, T.Yamada, K.Takahashi, S.Okamoto, T.Kamo, H.Funakubo, I.Koutsaroff, M.Zelner, and A.Cervin-Lawry: “Effect of Bottom Electrode on Dielectric Property of Sputtered-(Ba, Sr)TiO<sub>3</sub> Films”, *Journal of Applied Physics* (2009) in press [028911JAP].
- (13) T.Fujisawa, H.Nakaki, R.Ikariyama, T.Yamada, M.Ishikawa, H.Funakubo, and H.Morioka: “Crystal Structure and Electrical Property Comparisons of Epitaxial Pb(Zr,Ti)O<sub>3</sub> Thick Films Grown on (100)CaF<sub>2</sub> and (100)SrTiO<sub>3</sub> Substrates”, *Journal of Applied Physics* (2009) in press [032911JAP].
- (14) S.Yasui, M.Nakajima, H.Naganuma, S.Okamura, K.Nishida, T.Yamamoto, T.Iijima, M.Azuma, H.Morioka, K.Saito, M.Ishikawa, T.Yamada, and H.Funakubo: “Composition Control and Thickness Dependence of {100}-oriented Epitaxial BiCoO<sub>3</sub>-BiFeO<sub>3</sub> Films Grown by Metalorganic Chemical Vapor Deposition”, *Journal of Applied Physics* (2009) in press [033911JAP].
- (15) T.Fujisawa, H.Nakaki, R.Ikariyama, M.Nakajima, T.Yamada, M.Ishikawa, H.Morioka, T.Iijima, and H.Funakubo: “Growth of Epitaxial Pb(Zr,Ti)O<sub>3</sub> Thick Films on CaF<sub>2</sub> Substrates with Perfectly Polar-axis-orientation and Their Electrical and Mechanical Property Characterization”, *Mater. Res. Soc. Symp. Proc.*, (2009) in press.
- (16) S.Yokoyama, H.Funakubo, H.Morioka, K.Saito, T.Yamada, and M.Ishikawa: “Composition Dependency of Epitaxial Pb(Zr,Ti)O<sub>3</sub> Films with Different Film Thickness”, *Ferroelectrics* (2008) in press.

## 2) Review & Book

- (1) H.Funakubo and T.Yamada, “Recent Development of Thin films of Perovskite Oxide”, *Ceramics, the Ceramic Society of Japan*, 43, 634-638 (2008).
- (2) T.Yamada, N.Setter, and H.Funakubo “Self-assembled Growth of Ferroelectric-Dielectric Oriented Nanocomposite Films and Their Tunable Properties”, *Ceramics Data Book 2008*, 36, (90) 37-40 (2008).
- (3) H.Funakubo, S.Yasui, M.Ishikawa and T.Yamada: “Chemical Vapor Deposition of Ferroelectric Thin Films: A Critical Review”, A chapter in “*Ferroelectric Thin Films at Microwave Frequencies*”,

*Research Signpost books* (2008) under the editing.

### **3. Invited/Plenary Talks in Conference**

#### **1) International Conference or Workshop**

- (1) T.Yamada, C.Sandu, M.Gureev, V.O.Sherman, A.Noeth, A.K.Tagantsev, and N.Setter:  
“Self-Assembled Perovskite-Fluorite Oblique Nanostructures for Tunable Electronics”, 4th International Nanotechnology Conference on Communication and Cooperation, Nanotech in Japan (Tokyo, Japan) Apr. 2008. (Poster presentation)
- (2) T.Yamada, C.Sandu, M.Gureev, V.O.Sherman, A.Noeth, A.K.Tagantsev, N.Setter: “Self-assembled Growth of BaTiO<sub>3</sub>-CeO<sub>2</sub> Oriented Nano-composite Films and Their Tunable Properties”, The 25th Meeting on Ferroelectric Materials and Their Applications (FMA-25) (Kyoto) May 2008. (Oral presentation)
- (3) H.Funakubo, S.Ito, K.Takahashi, S.Okamoto, T.Kamo, T.Yamada, I.Koutsaroff, M.Zelner, and A.Cerwin-Lawry: “Effect of Bottom Electrode on Dielectric Property of Sputtered-(Ba,Sr)TiO<sub>3</sub> Films”, 20th International Symposium on Integrated Ferroelectrics (ISIF 2008) (Biopolis, Singapore) Jun. 2008. (Oral presentation)
- (4) T.Yamada, V.O.Sherman, A.K.Tagantsev, N.Setter, S.Okaura, S.Ito, T.Kamo, R.Ikariyama, S.Yasui, H.Funakubo: “Impact of Strain Modulation in Perovskite Ba–Sr–Ti–O and Pyrochlore Bi–Zn–Nb–O films on the Tunable Properties”, 5th International Conference on Microwave Materials and Their Applications (MMA-2008) (Hangzhou, China) Nov. 2008. (Invited talk)
- (5) T.Yamada, A.K.Tagantsev, H.Ohsumi, S.Kimura, T.Kamo, H.Morioka, K.Shinozaki, N.Setter, H.Funakubo: “Antiferrodistortive/Ferroelectric Phase Transitions and Correlated Properties in Compressively-strained Epitaxial SrTiO<sub>3</sub> Films”, 2008 MRS fall meeting (Boston MA, USA) Dec. 2008. (Oral presentation)

#### **2) Domestic Conferences**

- (1) T.Yamada, A.K.Tagantsev, P.Muralt, N.Setter, H.Funakubo: “Tunable Property of Strain-controlled Epitaxial SrTiO<sub>3</sub> Thin films by Two-step Growth Technique”, The 69th Autumn Meeting of the Japan Society of Applied Physics, (Kasugai, Aichi) Sep. 2008. (Memorial lecture for the Lecture Encouragement Prize)
- (2) T.Yamada, H.Funakubo, S.Kimura, H.Ohsumi, A.K.Tagantsev, N.Setter: “Ferroelectric Phase Transition and Dielectric Properties of Strained Epitaxial SrTiO<sub>3</sub> Films”, The 21st Fall Meeting of the Ceramic Society of Japan (Kitakyushu, Fukuoka) Sep. 2008. (Lecture)
- (3) T.Yamada, J.Wang, C.Sandu, Z.He, N.Setter, O.Sakata, T.Kamo, H.Funakubo: “Structural Analysis of

PX-phase Pb-Ti-O Single-crystal Nanowires using Micro X-ray Beam”, 2009 Annual Meeting of the Ceramic Society of Japan, (Noda, Chiba) Mar. 2009. (Oral presentation

- (4) T.Yamada, A.K.Tagantsev, T.Kiguchi, H.Ohsumi, S.Kimura, T.Iijima, H.Morioka, H.Funakubo: “Antiferrodistortive/Ferroelectric Phase Transitions in In-plane Compressed SrTiO<sub>3</sub> Films”, The 56th Spring Meeting of the Japan Society of Applied Physics (Tsukuba, Ibaraki) Mar. 2009 (Oral presentation)

#### **4. Patent**

- 1) T.Yamada, T.Kamo and H.Funakubo: “Tunable device and its production method”, National patent pending (2008-219661) Aug. 2008.

#### **5. Award**

- 1) The 24<sup>th</sup> Lecture Encouragement Prize of the Japan Society of Applied Physics  
2) Poster award for the excellent presentation in 2008 Annual Meeting of the Ceramic Society of Japan

#### **6. Others**

##### **1) International collaborations**

Collaboration with Dr. Dong Su in Center for Functional Nanomaterials (CFN) of Brookhaven National Laboratory: ‘Dislocations in epitaxial (Ba,Sr)TiO<sub>3</sub> films and these impact on tunable dielectric properties’ (CFN Proposal No. 358)