

DEVELOPMENT OF ENGINEERED ELECTRONICS MATERIALS WITH HIGH EXTERNAL FIELD RESPONSE.

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THE STUDY OUTLINE

We have investigated high performance electronics materials composed of environmental harmless elements. Especially, we focused on a response for an external electric and magnetic field in the electronics materials. In this research period, we have succeeded in finding three important properties for high performance electronic materials by controlling a thin film interface, crystal structure and domain structure as follows,

1. We succeeded in turning of magnetic state by controlling of an interface interaction in thin film using an external electric field.
2. We succeeded in high speed resistance switching by controlling of oxygen vacancy state in samples using an external electric field.
3. We achieved a high electromechanical longitudinal coupling factor by controlling of domain structure in samples.

ACADEMIC PAPERS (total 15papers)

1. "Preparation and magnetic properties of SrFeO_{3-x} ($x = 0.25 \sim 0.5$) using Radio Frequency magnetron sputtering method optimized by sputtering plasma analyses"

T. Yokota, S. Kito, S. Murata, and M. Gomi,

Vacuum 84,5,663–665 (2009)

2. "Electric field-induced resistance changes at low temperature on a Cr_2O_3 /ultra-thin $(\text{La,Sr})\text{MnO}_3$ magnetic hetero structure"

T. Yokota, S. Murata, S. Kito, and M. Gomi,

Journal of Ceramic Society of Japan 117[5], 639(2009)

3. "Influence of an External Magnetic Field on Injected Charges of a $\text{Cr}_2\text{O}_3/\text{Fe}/\text{CeO}_2/\text{Si}$ MIS Capacitor"

T. Yokota, S. Murata, S. Kito, and M. Gomi,

Key Engineering Materials, 421–422, 157(2009)

4. "Resistance Changes of $(\text{La}, \text{Sr})\text{MnO}_3$ Thin Film via Exchange Bias Tuning by the Application of an External Electric Field"

T. Yokota, S. Murata, S. Kito, and M. Gomi,

Key Engineering Materials, 421–422, 107(2009)

5. "Electrical Properties and Phase Transition Behavior of $(\text{Li,Na,Ba})(\text{Nb,Ti})\text{O}_3$ Lead-Free Piezoelectric Ceramics"

R. Aoyagi, R. Rinaldi, N. Sumiyama, M. Iwata and M. Maeda,

Key Engineering Materials, Vol.421–422, pp.42–45 (2009)

6 "Magnetic and Dielectric Properties of $\text{Cr}_2\text{O}_3/\text{LiNbO}_3/\text{Cr}_2\text{O}_3$ multi layer"

T. Yokota, Y. Tsuboi, S. Murata, S. Kito, and M. Gomi,

Electroceramics in Japan XIII, Key Engineering Materials, 107 (2010), pp.421–422

7. "Relationships between negative differential resistances and resistance switching properties of SrFeO_{2+x} thin films with excess oxygen"

T. Yokota, S. Kito, Y. Tsuboi, S. Murata, and M. Gomi,

Electroceramics in Japan XIII, Key Engineering Materials, 157(2010), pp.421–422

8. "Magneto-electric resistance modulation of $(\text{La}_{0.7}\text{Sr}_{0.3})\text{MnO}_3$ ferromagnetic thin film"

T. Yokota, S. Kito, Y. Tsuboi, S. Murata, and M. Gomi,

e-journal Surface Science and Nanotechnology, Vol. 8, (2010), pp.318–320

9. "Magnetic and Dielectric Properties of Cr₂O₃/LiNbO₃/Cr₂O₃ multi layer"
T. Yokota, Y. Tsuboi, S. Murata, S. Kito, and M. Gomi,
Electroceramics in Japan XIV, Key Engineering Materials, (accepted for publication)
10. "Electric field induced resistance change of SrFeO_{2.5-x} film"
S. Kito, T. Yokota, Y. Tsuboi, S. Murata, and M. Gomi,
e-journal Surface Science and Nanotechnology, Vol.8 (2010) 346-348
11. "Relationship between the resistance modulation and magneto-electric direction in Cr₂O₃/ultra-thin (La,Sr)O₃ hetero interface"
S. Kito, T. Yokota, Y. Tsuboi, S. Murata, and M. Gomi,
e-journal Surface Science and Nanotechnology (accepted for publication)
12. "Dielectric and Piezoelectric properties of (Na,Ba)(Nb,Ti)O₃ Lead-free Piezoelectric Ceramics"
R. Aoyagi, M. Maeda, and M. Iwata,
Key Eng. Mater. 445 (2010) pp.55-58.
13. "Electric Properties and Polarization Reversal in (Li,Na)NbO₃ Lead Free Piezoelectric Ceramics"
T. Ohashi, R. Aoyagi, M. Maeda, and M. Iwata,
Key Eng. Mater. (accepted).
14. "Local Structure Analysis of Li-Substituted NaNbO₃"
Y. Yoneda T. Ohashi, and R. Aoyagi,
Journal of the Korea Physical Society (accepted).
15. "Dielectric and Piezoelectric properties of (Na,Ba)(Nb,Ti)O₃ Lead-free Piezoelectric Ceramics"
R. Aoyagi, M. Maeda, and M. Iwata,
Key Eng. Mater. 445 (2010) pp.55-58.

CONFERENCE PRESENTATION (total 30 presentations)

1. "Preparation and Dielectric Properties of Cr₂O₃/Ferroelectric Film/Cr₂O₃ Hetero Structure"
Proc. of The 26th Korea-Japan international Seminar on Ceramics,
T. Yokota, Y. Tsuboi, S. Murata, S. Kito, and M. Gomi, 371-374 (2009)
2. "Magneto-charge injection property Cr₂O₃/Ferromagnetic filter/Cr₂O_{3-x}/Ferromagnetic filter/CeO₂/Si MIS capacitor"
Proc. of The 26th Korea-Japan international Seminar on Ceramics,
S. Murata, T. Yokota, Y. Tsuboi, S. Kito, and M. Gomi, 529-532(2009)
3. "Electric Field Induced Resistance Changes in SrFeO_{2+x} Thin Films with Various Oxygen Contents"
Proc. of The 26th Korea-Japan international Seminar on Ceramics,
S. Kito, T. Yokota, S. Murata, Y. Tsuboi, and M. Gomi, 378-381(2009)
4. "Relationships between electric field induced resistance changes and an exchange interaction in interface of Cr₂O₃/La_{1-x}Sr_xMnO₃ magnetic hetero structure"
T. Yokota, S. Murata, S. Kito, and M. Gomi,
Extended Abstracts of 14th US-Japan Seminar on Dielectric and Piezoelectric Materials, pp.227-230 (2009)(invited)
5. "Phase Transition Temperature Shift of (Li,Na)NbO₃ Lead-Free Piezoelectric Ceramics by High-Electrical-Field Poling"
R. Aoyagi, M. IWATA, M. Maeda,
Extended Abstracts of 14th US-Japan Seminar on Dielectric and Piezoelectric Materials, pp.284-287 (2009) (invited)
6. "Electric Field Induced Magneto-resistance Changes of (La,Sr)MnO₃ Film"
Proc. of The 27th Korea-Japan international Seminar on Ceramics,
T. Yokota, S. Kito, Y. Tsuboi, R. Imura, and M. Gomi, 190-191(2010)

7. "Electric Field Induced Resistance Change of Environmental Harmless Material CaFeO_{2.5212}"
Extended abs. of The 27th Korea-Japan international Seminar on Ceramics,
S. Kito, T. Yokota, Y. Tsuboi, R. Imura, and M. Gomi, 212-213(2010)
8. "Influence of magneto-electric coefficient for magnetic and electric charge injection properties on magneto-electric MIS capacitor"
T. Yokota, Y. Tsuboi, R. Imura, S. Kito, and M. Gomi,
3rd International Congress on Ceramics, S6-065, Osaka, Japan.
9. "Cr₂O₃/LiNbO₃/Cr₂O₃ 積層膜における結晶性と磁気特性の相関"
横田 壮司、坪井康敏、鬼頭伸也、井村 廉平、五味 学,
第 30 回エレクトロセラミックス研究討論会, 2P49, 森戸記念館(東京都新宿区)
10. "Preparation of magnetic oxide ceramics for oxygen sensors"
Takeshi YOKOTA, Sinya KITO, Qi XIA, Miloslaw BATENTSCHUK, Manabu GOMI and Christoph J. BRABEC,
4th International Workshop on Advanced Ceramics, B209, Nagoya, Japan.
11. "RRAM 用 CaFeO_{3-x} の作製及び電界誘起抵抗変化特性"
横田 壮司、鬼頭伸也、坪井康敏、井村 廉平、五味 学,
第 49 回セラミックス基礎討論会, 2F04, 岡山コンベンションセンター(岡山市)
12. "Magnetic and electric field induced resistance change in SrFeO_{3-x} thin film"
S. Kito, T. Yokota, Y. Tsuboi, R. Imura, and M. Gomi,
3rd International Congress on Ceramics, S6-P044, Osaka, Japan.
13. "Relationship between the resistance modulation and magneto-electric direction in Cr₂O₃/ultra-thin (La,Sr)O₃ hetero interface"
S. Kito, T. Yokota, R. Aoyagi and M. Gomi,
6th International Workshop on Nano-Scale Spectroscopy & Nanotechnology, 2010, Hyogo, Japan
14. "Magnetic and electric field induced resistance change in SrFeO thin film",
Shinya KITO, Takeshi YOKOTA, Qi Xia, Miloslaw BATENTSCHUK, Manabu GOMI and Christoph J. BRABEC,
4th International Workshop on Advanced Ceramics, B211, Nagoya, Japan.
15. "電界誘起抵抗変化物質 Ca_{1-x}Sr_xFeO_{2.5}(X=0-0.4)における抵抗変化特性の探査"
鬼頭伸也、横田 壮司、坪井康敏、井村 廉平、五味 学,
平成 22 年度東海支部学術研究発表会、A06, 名城大学天白キャンパス(名古屋市)
16. "Cr₂O₃/Cr₂O₃±X/LiNbO₃/Cr₂O₃±X/Cr₂O₃ 積層膜における磁気特性の探査"
坪井康敏、横田 壮司、鬼頭伸也、井村 廉平、五味 学,
第 40 回東海若手セラミスト懇話会 2010 年夏期セミナー, P44, 下呂温泉山形屋(下呂市)
17. "Cr₂O₃/Cr₂O₃±X/LiNbO₃/Cr₂O₃±X/Cr₂O₃ 積層膜における磁気・誘電特性"
坪井康敏、横田 壮司、鬼頭伸也、井村 廉平、五味 学,
平成 22 年度東海支部学術研究発表会、A25, 名城大学天白キャンパス(名古屋市)
18. "Room Temperature Magneto-electric Effects of Cr₂O₃/Cr₂O₃±X/LiNbO₃/Cr₂O₃±X/Cr₂O₃ Hetero Structure"
Yasutoshi TSUBOI, Takashi YOKOTA, Shinya KITO, Rempei IMURA, and Mamabu GOMI,
4th International Workshop on Advanced Ceramics, B212, Nagoya, Japan.
19. "ME 記憶素子における多段階電荷・スピン注入とトンネル層厚の相関"
井村 廉平、横田 壮司、坪井康敏、鬼頭伸也、五味 学,
第 40 回東海若手セラミスト懇話会 2010 年夏期セミナー, P43, 下呂温泉山形屋(下呂市)
20. "電気磁気効果材料をゲート絶縁膜とする Si-MIS キャパシタにおける多段階電荷注入特性及び外部磁場の影響"
井村廉平・横田壮司・坪井康敏・鬼頭伸也・五味学,
平成 22 年度東海支部学術研究発表会、A12, 名城大学天白キャンパス(名古屋市)

21. "Electrical Properties in (Li,Na)NbO₃ Piezoelectric Ceramics after Poling Treatment"
R. Aoyagi, T. Ohashi, M. Maeda, M. Iwata, and T. Shiosaki,
2010 U.S. Navy Workshop on Acoustic Transduction Materials and Devices, VII.3, State College, PA, USA. (invited)
22. "(Li,Na)NbO₃ 系非鉛圧電セラミックスの分極処理と電気的特性"
青柳倫太郎, 大橋敬之, 前田雅輝, 岩田真, 塩峯忠,
第 27 回強誘電体応用会議, 29-P-19, コープイン京都(京都市)
23. "(Li,Na)NbO₃ 系非鉛圧電セラミックスの誘電特性と分極電界依存"
大橋敬之, 新井信帆, 山田智文, 青柳倫太郎,
第 40 回東海若手セラミスト懇話会 2010 年夏期セミナー, P51, 下呂温泉山形屋(下呂市)
24. "(Li,Na)NbO₃ 系非鉛圧電セラミックスの分極反転と圧電特性"
青柳倫太郎, 大橋敬之, 前田雅輝, 岩田真,
第 71 回応用物理学会学術講演会, 14p-ZR-15, 長崎大学(長崎市)
25. "(Li,Na)NbO₃ 系非鉛圧電セラミックスの分極反転と電気的特性"
大橋敬之, 青柳倫太郎, 前田雅輝, 岩田真,
第 30 回エレクトロセラミックス研究討論会, 2P21, 森戸記念館(東京都新宿区)
26. "Poling Field Dependence of Piezoelectric and Dielectric Properties in (Li,Na)NbO₃ Lead-Free Piezoelectric Ceramic"
R. Aoyagi, T. Ohashi, M. Maeda, M. Iwata, and T. Shiosaki,
3rd International Congress on Ceramics, S6-P070, Osaka, Japan.
27. "Poling Field Dependence of Piezoelectric Properties in (Li,Na)NbO₃ Lead-Free Ceramics"
Takayuki OHASHI, Rintaro AOYAGI, Masaki MAEDA, Makoto IWATA,
The 27th International Korea-Japan Seminar on Ceramics, EC-O-15, Incheon, Korea
28. "Effects of polarization switching on electric properties of lead-free (Li,Na)NbO₃ Ceramics"
Takayuki OHASHI, Rintaro AOYAGI, Tomofumi YAMADA,
4th International Workshop on Advanced Ceramics, B210, Nagoya, Japan.
29. "Poling field dependence of electric properties in (Li,Na)NbO₃ lead-free piezoelectric Ceramics"
Rintaro AOYAGI, Takayuki OHASHI, Tomofumi YAMADA,
4th International Workshop on Advanced Ceramics, P19, Nagoya, Japan.
30. "(Li,Na,K)NbO₃ 系非鉛圧電セラミックスの分極処理と電気的特性"
山田智文, 新井信帆, 青柳倫太郎, 前田雅輝: 日本セラミックス協会年会(静岡大学(浜松市)) 2P037