

Takaaki Tsurumi, Prof.

Department of Metallurgy and Ceramics Science

1. Main Research Results

For ultrasonic motors using lead-free piezoelectric ceramics, a new design was proposed to enhance the motor torque, and the relation between motor performance and material properties was elucidated. A lead-free tube-type ultrasonic motor with a small radius has also been developed. These motors were operated by the shear-mode of piezoelectric elements. A method to accurately measure the displacement of shear-mode vibration was developed by utilizing laser Doppler interferometer. A micropump operated by a lead-free piezoelectric ceramics has been developed for the use of the insulin injection in the body of diabetes.

2. List of publication (original article, comment/book)

1) Original Paper

- (1) Enzhu Li, Hirofumi Kakemoto, Takuya Hoshina, and Takaaki Tsurumi; "A Shear-Mode Ultrasonic Motor Using Potassium Sodium Niobate-Based: Ceramics with High Mechanical Quality Factor", *Jpn. J. Appl. Phys.*, 47, 7702-7706 (2008).
- (2) Takuya Hoshina, Kayo Takizawa, Jianyong Li, Takeshi Kasama, Hirofumi Kakemoto, and Takaaki Tsurumi, "Domain Size Effect of Dielectric Properties of Barium Titanate Ceramics" *Jpn. J. Appl. Phys.*, 47, 7607-7611(2008).
- (3) Takuya Hoshina, Satoshi Wada, Yoshihiro Kuroiwa, and Takaaki Tsurumi, "Composite structure and size effect of barium titanate nanoparticles", *Appl. Phys. Lett.*, 93, 192914 (2008).
- (4) Ryo Sasaki, Ryo Suzuki, Shingo Uraki, Hirofumi Kakemoto, and Takaaki Tsurumi, "Low-temperature sintering of alkaline niobate based piezoelectric ceramics using sintering aids", *J. Ceram. Soc. Jpn.*, 116, 1182-1186 (2008).
- (5) Ryo Suzuki, Shingo Uraki, Enzhu Li, Takuya Hoshina, and Takaaki Tsurumi, "Influence of Bi-perovskites on the piezoelectric properties of (K_{0.5}Na_{0.5})NbO₃-based lead free ceramics", *J. Ceram. Soc. Jpn.*, 116, 1199-1203 (2008).
- (6) Ryo Sakamaki, Takuya Hoshina, Hirofumi Kakemoto, Kouichi Yasuda, Hiroaki Takeda, Jun Akedo, and Takaaki Tsurumi, "Heat-cycle endurance and in-plane thermal expansion of Al₂O₃/Al substrates formed by aerosol deposition method", *J. Ceram. Soc. Jpn.*, 116, 1299-1303 (2008).
- (7) Norihiro Horiuchi, Takatoshi Matsuo, Takuya Hoshina, Hirofumi Kakemoto, and Takaaki Tsurumi, "Effect of depletion layers on scaling effect in barium strontium titanate epitaxial films", *Appl. Phys. Lett.* (2009) in press.
- (8) K. Takeda, T. Muraishi, T. Hoshina, H. Kakemoto and T. Tsurumi; "Birefringence and Electro-optic Effect in Epitaxial BST Thin Films", *Mater. Sci. Eng. B* (2009) in press.
- (9) Takashi Teranishi, Takuya Hoshina, Takaaki Tsurumi, "Wide range dielectric spectroscopy on perovskite dielectrics", *Mater. Sci. Eng. B* (2009) in press.

- (10) Yu Yonezawa, Hiroyuki Kinbara, Hiroki Umehara, Hirofumi Kakemoto, Takuya Hoshina, Hiroaki Takeda, and Takaaki Tsurumi; “Fabrication of Dielectric/Conductive Hybrid Artificial Superlattices using Molecular Beam Epitaxy Method”: Key Engineering Materials (2009) in press.
- (11) Kensuke Mihara, Takuya Hoshina, Hirofumi Kakemoto, Hiroaki Takeda and Takaaki Tsurumi; “Effects of Pretreatments on deposition rate of Films in Aerosol Deposition Method”: Key Engineering Materials (2009) in press.
- (12) Takashi Teranishi, Takuya Hoshina, Hiroaki Takeda and Takaaki Tsurumi; “Polarization Behavior in Diffuse Phase Transition of $Ba_xSr_{1-x}TiO_3$ Ceramics”, J. Appl. Phys., (2009) in press.

3. Invited/Plenary Talks in Conference

1) International Conference or Workshop

- (1) Takaaki Tsurumi, Takashi Matsuo, Takuya Hoshina and Hirofumi Kakemoto; “Size Effect and Dead Layer of BST Thin Films”: 17th IEEE International Symposium on Applications of Ferroelectrics, (2008). Oral.
- (2) Takaaki Tsurumi, “Size Effect of Barium Titanate and MLCCs in the Next Generation”; 17th IEEE International Symposium on Applications of Ferroelectrics, (2008). Oral.
- (3) K. Takeda, T. Muraishi, T. Hoshina, H. Kakemoto and T. Tsurumi; “Correlation between electro-optical coefficient and dielectric permittivity of BST thin films”: 17th IEEE International Symposium on Applications of Ferroelectrics, (2008). Poster.
- (4) Takaaki Tsurumi, Takashi Matsuo, Takuya Hoshina and Hirofumi Kakemoto; “Size Effect and Dead Layer of BST Thin Films”, 2008 MRS Spring Meetings, (2008). Oral.
- (5) Takaaki Tsurumi and Takuya Hoshina, “Size Effect of Barium Titanate and MLCCs in the Next Generation”; 2008 MRS Spring Meetings, (2008). Invited.
- (6) Takuya Hoshina, Hirofumi Kakemoto, Takaaki Tsurumi, Satoshi Wada; “Composite Structure and Size Effect of Barium Titanate Nanoparticles”, IMAPS/AcerS 4th, (2008). Oral.
- (7) Takaaki Tsurumi, “Size Effect of Barium Titanate Based Nano-particles and Thin Films; 9th Russia/CIS/Baltic/Japan Symposium of Ferroelectricity, (2008). Invited.
- (8) Takaaki Tsurumi, Enzhu Li, Ryo Suzuki, Takuya Hoshina, “Ultrasonic Motors and Ink-jet Heads Using Shear Mode of Lead-free Piezoelectric Ceramics”, The 6th Asian Meeting on Ferroelectrics, (2008). Oral.
- (9) Takaaki Tsurumi, Enzhu Li, Ryo Suzuki, Shingo Uraki, Takuya Hoshina,; “ Shear Mode Ultrasonic Motor and Ink-jet Head Using Lead-Free Alkaline Niobate Ceramics: Materials Science & Technology Conference and Exhibition, (2008). Invited.
- (10) Takashi Teranishi, Jianyong Li, Takuya Hoshina, Hirofumi Kakemoto, Takaaki Tsurumi; “Wide Band Dielectric Spectroscopy of $(Ba,Sr)TiO_3$ Ceramics and its Microscopic Mechanism of Dielectric Property”, 6th Asian Meetings on Electroceramics, (2008).Oral.

- (11) Yu Yonezawa, Hiroyuki Kinbara, Yuki Umehara, Takuya Hoshina, Hirohumi Kakemoto, Tsurumi Takaaki; "Fabrication of Dielectric/Conductive Hybrid Artificial Superlattices using Molecular Beam Epitaxy Method": 6th Asian Meetings on Electroceramics, (2008).Poster.
- (12) Kensuke Mihara, Akihiro Komatsu, Takuya Hoshina, Hirofumi Kakemoto, Takaaki Tsurumi; "Clarification of Thickness Decision Factor in Aerosol Deposition Method": 6th Asian Meetings on Electroceramics, (2008).Poster.
- (13) Takuya Hoshina, Katsushi Osada, Takaaki Tsurumi, "Particle Structure and Dielectric Property of Barium Titanate Fine Particles", 6th Asian Meetings on Electroceramics, 2008. Poster.
- (14) Takaki Tsurumi, "Dielectric Dispersion in Perovskite Ferroelectrics", IUMRS-ICA(2008).Invited.
- (15) Youn-Kyu Choi, Takuya Hosina and Takaaki Tsurimi, "The study of Zr-doped BCTZ ceramics sintered in reducing atmosphere with high frequency", IUMRS-ICA(2008).Oral.
- (16) Kotaro Takeda, Takuya Hoshina, and Takaaki Tsurumi, "Piezoelectric Constant and Electro-Optical Coefficient of LN Single Crystal at Resonance Frequency", IUMRS-ICA(2008).Poster.
- (17) Masaru Ohno, Takuya Hoshina, Hiroaki Takeda and Takaaki Tsurumi; "Fabrication of Multilayered Photonic Crystal by RF Magnetron Sputtering", IUMRS-ICA(2008).Poster.
- (18) T. Tsurumi, T. Hoshina and H. Takeda, "Piezoelectric Applications of Alkaline-Niobate-based Lead-free Ceramics"; Piezo Institute,(2009) Invited.

4. Others

Ink-jet heads using lead-free piezoelectric ceramics, 19/05/2008, Nikkei News Paper