



2024 INTERNATIONAL WORKSHOP ON ACOUSTIC TRANSDUCTION MATERIALS AND DEVICES



Agenda

Tuesday May 7, 2024

Session I: Plenary 1

GENERAL SESSION

Session Chair: Susan Trolier-McKinstry

President's Hall 1 & 2

	8:00 – 8:10	Introductory Remarks	Susan Trolier-McKinstry, Richard J. Meyer, Jr.
I.1	8:10 – 8:25	Replacing Hard Piezoceramic with Mn:PIN-PMN-PT in Surgical Devices - X. Li, N. Giles-Donovan, S. Cochran, M. Lucas	Sandy Cochran
I.2	8:30 – 8:45	Applicability of Lead Free Piezoelectrics to Ultrasonic Evaluation - T. Comyn, P. Cowin, C. Wang, R. Todd, A. Bell	Tim Comyn
I.3	8:50 – 9:05	Auto-charging Bridgman Growth and Characterization of 100 mm Diameter Undoped and Mn-doped PIN-PMN-PT Crystals - J. Luo, S. Dursun, H. Marshall, S. Dynan	Jun Luo
I.4	9:10 – 9:25	Hybrid and All-Inorganic Halide Perovskite Single Crystals: Growth, Domain Structures and Ferroelasticity - Z. Ye, M. Bari, A. Bokov	Zuo-Guang Ye
I.5	9:30 – 9:45	Additively Manufactured (AM) Piezoelectric Metamaterials - B. Pazol, B. Robinson, A. Allan, J. Tufariello, A. Angilella, C. Corrado, K. Bernero, M. Kay, E. Abercrombie, R. Fordham, N. Veolim	Brian Pazol
	9:50 – 10:30	Morning Break	
I.6	10:30 – 10:45	Textured Lead Zirconate Titanate Ceramics - S. Zhang, F. Li	Shujun Zhang
I.7	10:50 – 11:05	The impact of Coupling Factor and Mechanical Q on Acoustic Transducers - H.C. Robinson	Hal Robinson
I.8	11:10 – 11:25	Electric Field Dependence of Capacitance and Dissipation Properties for Acoustic Projector Materials - J.J. Fox, J.E. Brown, J.L. Peters, R.J. Meyer, M.A. Fanton	Joshua Fox
I.9	11:30 – 11:45	Acoustic Metamaterials - A. Hanford	Amanda Hanford
	11:50– 12:02	Three-Minute Summaries	
I.10	11:50 – 11:53	Contract Ceramic Processing - R. Petrucci, W. Coburn	Russell Petrucci
I.11	11:53 – 11:56	APC International, Ltd., Products and Services - J. Zahnd, B. Park	Brian Park
I.12	11:56 – 11:59	Smart Material Corp., Display Of Products - T. Daue	Thomas Daue
I.13	11:59 – 12:02	Gen III PMN-PZT Single Crystal-Polymer Composites for Medical (Imaging and HIFU) and NDT Ultrasound Transducers - M.-J. Yoon, H.-J. Joo, M.-C. Kim, S.-W. Ko, H.-Y. Lee	Ho-Yong Lee
I.14	Poster Only	CTS Corporation Piezoelectric Products - S. Hulick	Scott Hulick
I.15	Poster Only	TRS Technologies - S. Dynan, J. Luo, S. Dursun, T. Baney	Todd Baney
I.16	Poster Only	Micromechatronics, Inc. - Your Smart Materials Development Partner - A. Vazquez Carazo	Alfredo Vazquez Carazo



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Session II: Ferroelectric Films for MEMS

CONCURRENT SESSION

Session Chair: Nazanin Bassiri Gharb

President's Hall 1

II.1	2:00–2:15	The Effect of Surface Termination on Electrical Reliability of KNN Films - B. Akkopru-Akgun, S. Trolier-McKinstry	Betul Akkopru-Akgun
II.2	2:20–2:35	Reliability of Piezoelectric Films for MEMS - S. Trolier-McKinstry, W. Zhu, B. Akkopru-Akgun, F. He	Susan Trolier-McKinstry
II.3	2:40–2:55	Measuring Direct e_{31} from the Converse e_{31} Effect - J.T. Evans, M.S. McDaniel, N.B. Montross, S.W. Smith, B. Martinez-Tovar, E. Villanueva	Joe T. Evans
II.4	3:00–3:15	Quantitative Piezoelectric Measurements of Partially Released $Pb(Zr,Ti)O_3$ Structures - P. Tipsawat, X. Zheng, Q.T. Tran, T.N. Jackson, S. Trolier-McKinstry	Pannawit Tipsawat
	3:20–4:00	Afternoon Break	
II.5	4:00–4:15	Reducing User-bias in PFM signal Interpretation by Machine Learning Analysis - G.K. Ligonde, N. Bassiri-Gharb	G. Kevin Ligonde
II.6	4:20–4:35	Electrocaloric Effects and Polarization Stability Study of High Entropy Perovskite Oxide Films - Y. Son, S. Udovenko, J. Barber, C. Rost, S. Trolier-McKinstry	Yeongwoo Son
	4:40–4:55	Three-Minute Summaries	
II.7	4:40–4:43	Tuning Pb Content in Chemical Solution Processed $PbZrO_3$ Thin Films - M.H. Haddad, K. Holsgrove, A. Kumar, N. Bassiri-Gharb	Milan Haddad
II.8	4:43–4:46	Chemical Solution Processing of Antiferroelectric $PbHfO_3$ Thin Film - S. Shin, N. Bassiri-Gharb	Seonkyu Shin
II.9	4:46–4:49	Effective Moisture Protection for Bulk and Thin Film Piezoelectric Actuators - A. Diaz-Huemme, J. Neumüller, S. Trolier-McKinstry	Anthony Diaz-Huemme
II.10	4:49–4:52	Ferroelectric Nonlinearity and Aging of Potassium Sodium Niobate - T. Zhao, B. Akkopru-Akgun, S. Trolier-McKinstry	Tianming Zhao
II.11	4:52–4:55	piezoMEMS Arrays on Metal Foils - K. Nakamura, S. Trolier-McKinstry	Kae Nakamura



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Session III: Transducers and Ultrasound

CONCURRENT SESSION

Session Chair: Mark Fanton

President's Hall 2

III.1	2:00 – 2:15	High Piezoelectric Constant Mn:PIN-PMN-PT and High-Q Applications - S.-G. Lee, Y. Jeong, H. Yoon, Y. Je, H.S. Seo	Sang-Goo Lee
III.2	2:20 – 2:35	Compact, Broadband Underwater Transducers and Arrays - L.C. Lim, Y.X. Xia, J.H. Koh, F.C. Lim, L. Wang	Leong-Chew Lim
III.3	2:40 – 2:55	An Ultra-high-power Density Piezoelectric Cryogenic Actuator for NASA Space Missions - T.-B. Xu, J. Huffine, X. Jiang, S. Zhang	Tian-Bing Xu
III.4	3:00 – 3:15	Exploiting New Transduction Modality for Sound Projectors - P. Finkel, M. Staruch, T. Mion	Peter Finkel
	3:20–4:00	Afternoon Break	
III.5	4:00 – 4:15	Squitter Transducer - I.M. Doyle, S.C. Butler	Ian M. Doyle
III.6	4:20 – 4:35	Magnetic Energy Harvesting by Magneto-Mechano-Electric (MME) Effect in Piezoelectric Single Crystal Fiber Composites - J. Ryu, H. Song, D.Y. Jeong	Jungho Ryu
III.7	4:40 – 4:55	Degradation Monitoring of Multilayer Ceramic Capacitors During Highly Accelerated Lifetime Testing Using Ultrasound - H.N. Jones, A.P. Arguelles, S. Trolrier-McKinstry	Haley Jones
	5:00 – 5:12	Three-Minute Summaries	
III.8	5:00 – 5:03	Experimental Testing of a Double-octave Piezoelectric Transducer for Large-band Underwater Communication - A. Aubry, G. Marin, S.A. Clement, F. Jean, F. Mosca	Simon A. Clement
III.9	5:03 – 5:06	Resonant Impedance Behaviors of a Flexensional Piezoelectric Transducer by Mechanical and Electrical Excitations - T.-B. Xu, B. Zhao	Tian-Bing Xu
III.10	5:06 – 5:09	Proof Mass Effect on Flexensional Piezo-electric Energy Harvest Performance - B. Zhao, T.-B. Xu	Bingqi Zhao
III.11	5:09 – 5:12	Charging Processing Behaviors from a Piezoelectric Energy Harvester to a Super-capacitor - B. Zhao, T.-B. Xu	Bingqi Zhao



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Wednesday May 8, 2024

Session IV: Plenary 2 - Crystal Growth and Properties

GENERAL SESSION

Session Chair: **Sandy Cochran**

President's Hall 1 & 2

IV.1	8:30 – 8:45	High Coercive Field Observed in Rare Earth Modified Piezoelectric Single Crystals - K. Grove and J. Tian	Kyle M. Grove
IV.2	8:50 – 9:05	Extraordinary Properties of Gen III PMN-PZT Single Crystals Fabricated by Solid-state Crystal Growth (SSCG) Technique - M.-C. Kim, M.-J. Yoon, D.-H. Kim, H.-Y. Lee	Ho-Yong Lee
IV.3	9:10 – 9:25	Macro- and Microstructure of Lead Perovskite Ternary Piezoelectric Single Crystals After DC and AC Poling - H. Maiwa, Y. Xiang, Y. Sun, T. Karaki, Y. Yamashita	Hiroshi Maiwa
IV.4	9:30 – 9:45	Enhanced Piezoelectric Properties of Mn-doped PIN-PMN-PT Single Crystals via Alternating Current Poling - Z. Xu, S. Liu, Y. Yamashita, X. Jiang	Zhengze Xu
9:40 – 10:20 Morning Break			
IV.6	10:20 – 10:35	Comparison of AC and DC Poled PMN-PT Single Crystals using Dielectric Spectroscopy - A.A. Bokov, H. Guo, Z.-G. Ye	Alexei A. Bokov
IV.7	10:40 – 10:55	Electric Depolarization of Relaxor-PT Single Crystals at Room Temperature - Z. Xu, J.-W. Sun, S. Liu, Y. Yamashita	Zhengze Xu
IV.8	11:00 – 11:15	What We Need to Know about Alternating Current Poling for Piezoelectric Single Crystals—a Review for 2023-2024 - Y. Yamashita, H. Maiwa, Z. Xu, X. Jiang	Yohachi (John) Yamashita
IV.9	11:20 – 11:35	Electrical Characterization of Sm-doped PIN-PMN-PT Crystals Grown by Bridgman Method - S. Dursun, J. Luo, H. Marshall, S. Dynan	Sinan Dursun
11:40 – 11:58 Three-Minute Summaries			
IV.10	11:40 – 11:43	Full Material Constants of Alternating Current Poled PMN_{0.3}PbTiO₃ Single Crystals Grown by the Continuous Feeding Bridgman Process - Y. Yamashita, Y. Xiang, H. Maiwa, Z. Xu, X. Jiang	Yohachi (John) Yamashita
IV.11	11:43 – 11:46	Nanoscale Depoling Studies as a Function of Temperature in a Relaxor Ferroelectric-Based Ternary Single Crystal - I. Stepanek, G.K. Ligonde, Z.-G. Ye, N. Bassiri-Gharb	Isabella Stepanek
IV.12	11:46 – 11:49	Wet Etching of PIN-PMN-PT Single Crystal - T. Shirai, J. Luo, S. Dynan	Takaki Shirai
IV.13	11:49 – 11:52	Self-poling and Piezoelectric Properties of Mn doped Pb(Mg_{1/3}Nb_{2/3})O₃-Pb(ZrTi)O₃ Single Crystals Grown by Solid State Crystal Growth Process - H. Maiwa, Y. Yamagata, Y. Xiang, H. Sun, H.-Y. Lee, Y. Yamashita	Hiroshi Maiwa
IV.14	11:52 – 11:55	Microstructure Observation of Pb(Mg_{1/3}Nb_{2/3})O₃-PbTiO₃ Single Crystals by Scanning Electron Microscope - H. Maiwa, Y. Xiang, Y. Sun, T. Karaki, Y. Yamashita	Hiroshi Maiwa
IV.15	11:55 – 11:58	Spontaneous (or Self-) Poling in Mn-doped (001) PMN-PZT Single Crystals Grown by Solid-state Single Crystal Growth (SSCG) Method - H. Maiwa, M.-J. Yoon, H.-J. Joo, M.-C. Kim, S.-W. Ko	Ho-Yong Lee



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| IV.16 | Poster Only | High-Power Characteristics and Acoustic Performances in Sonar Projectors of PIN-PMN-PT Single Crystals and Textured Ceramics - T. Sano, S. Kondo, K. Hasebe, M. Yamamoto, S. Takahashi, M. Umeda | Takahiro Sano |
| IV.17 | Poster Only | High Power Reliability of AC Poled Single Crystals - Y. Cardona Quintero, R. Pérez Moyet, A.A. Heitman | Yenny Cardona Quintero |
| IV.18 | Poster Only | Phase Coexistence from High Temperature AC Poling - R. Pérez Moyet, Y. Cardona Quintero, A.A. Heitman | Richard Pérez Moyet |



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Session V:		Other Transduction Materials and Bar Transducers	CONCURRENT SESSION
Session Chair:		Beecher Watson	President's Hall 1
V.1	2:00 – 2:15	Piezoelectric PVDF-TrFE Transducer and Quantitative AC Poling System - S. Zhang, H. Zhang, B. Li, Y. Chen	Shihai Zhang
V.2	2:20 – 2:35	Relaxor Ferroelectric Polymer Exhibits High Electromechanical Coupling at Low Electric Fields - W. Zhu, X. Chen, Q. Zhang, H. Qin, W. Lu, J. Bernholc	Wenyi Zhu
V.3	2:40 – 2:55	Novel Organic Piezoelectric Materials - S.G. Dunning, A. Raeliarijaona, R.E. Cohen, T.A. Strobel	Aldo Raeliarijaona
V.4	3:00 – 3:15	Flexoelectricity Induced from Interfacial Polarization in Silicon-based Barrier Layer Capacitors - R. Hawks, T. Peters, G. Lavallee, L. Collins, R. Meyer Jr., S. Roundy, S. Trolier-McKinstry	Ryan Hawks
3:20 – 4:00		Afternoon Break	
V.5	4:00 – 4:15	Resonance Controllable Bender Transducer Based on Piezoelectric Single Crystals - Y. Je, M.-J. Sim, S. Lim, S.-G. Lee, Y. Cho, H.S. Seo	Yub Je
V.6	4:20 – 4:35	Modeling Flexural Bar Transducers with Multidomain Analysis Methods - S. Thompson	Steve Thompson
4:40 – 4:55		Three-Minute Summaries	
V.7	4:40 – 4:43	Locating the Morphotropic Phase Boundary in PYN-PMN-PZT Ceramics via the Landau Theory - A.A. Heitman	Adam A. Heitman
V.8	4:43 – 4:46	Effects of Grain Neighborhood on Local Piezoelectric Response and Stress Concentration in Bulk Polycrystals - R.J. Knox, S. Trolier-McKinstry, D.C. Pagan	Reilly Knox
V.9	4:46 – 4:49	Characterization of Textured Piezoelectric Ceramics - A. Alexandrou, S. Cochran, R. O'Leary	Anna Alexandrou
V.11	4:52 – 4:55	Electromechanical Transduction Material and Microelectronics Development by Hybrid 3-Dimensional Deposition and Development (H3D) - P. Flynn, S. Garnsey, L. Santillan, S. Day, A. Bhalla, R. Guo	Sean Garnsey
V.12	Poster Only	Effects of Particle Size on Laser/Powder Interaction During Laser Sintering of PMN-PZT Structures - A.B. Fanton, J.J. Fox, C.D. Eadie	Andrew B. Fanton
V.13	Poster Only	Injection Molding of Porous PZT Ceramic - B. Robinson, B. Pazol, T. Snedeker, S. Neov, R. Gravel, D. Fyler, R. Johnson, S. Mills	Barry Robinson
V.14	Poster Only	Impact of Sintering Atmosphere in Perovskite Dielectric and Piezoelectric Materials - H. Nishiyama, H. Shimizu, C.A. Randall	Hiroshi Nishiyama



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Session VI: Novel Ferroelectric Films and Domain Characterization		CONCURRENT SESSION
Session Chair: Betul Akkopru-Akgun		President's Hall 2
VI.1	2:00 – 2:15 Thickness-dependency of Ferroelectric and Piezoelectric Properties in HfO₂-CeO₂ Film - K. Hirai, T. Shiraishi, W. Yamaoka, R. Tsurumaru, Y. Inoue, K. Okamoto, H. Funakubo	Kazuki Okamoto
VI.2	2:20 – 2:35 Self-heating of Al_{1-x}B_xN in Ferroelectric Memory Devices - K. Kang, J.A. Casamento, Y. Song, N.S. McIlwaine, J.-P. Maria, S. Choi, S. Trolrier-McKinstry	Kyuhwe Kang
VI.3	2:40 – 2:55 Ferroelectric Switching in Sub 10 nm Al_{1-x}B_xN Films - Q.T. Tran, J.-P. Maria, J.A. Casamento, J. Hayden, T.N. Jackson	Quyen Tran
VI.4	3:00 – 3:15 Switching Kinetics in Ferroelectric (Zn,Mg)O - <u>L.C. Jacques</u> , E. Ozdemir, P. Yousefian, K. Yazawa, P. Tipsawat, J. Spurling, J.-P. Maria, S. Trolrier-McKinstry	Leonard Jacques
3:20 – 4:00 Afternoon Break		
VI.5	4:00 – 4:15 Optical Imaging of Inversion Domain Walls In Ferroelectric Wurtzite Thin Films and Heterostructures - A. Suceava, C. Skidmore, J. Hayden, S. Trolrier-McKinstry, J.-P. Maria, V. Gopalan	Albert Suceava
VI.6	4:20 – 4:35 A Nanodiffraction Imaging Technique for Visualization of Domain Structure in Ferroelectric Materials - S.A. Udovenko, D.C. Pagan, S. Trolrier-McKinstry	Stanislav Udovenko
4:40 – 4:49 Three-Minute Summaries		
VI.7	4:40 – 4:43 Coercive Field Engineering of Ferroelectric Zinc Magnesium Oxide - L.C. Jacques, P. Yousefian, J. Spurling, E. Ozdemir, B. Akkopru-Akgun, J.-P. Maria, S. Trolrier-McKinstry	Leonard Jacques
VI.8	4:43 – 4:46 Defect Chemistry of Al_{1-x}Sc_xN and Al_{1-x}B_xN and its Impact on Ferroelectric Properties - E. Ozdemir, P. Yousefian, L.C. Jacques, B. Akkopru-Akgun, R. Olsson, J.-P. Maria, C.A. Randall, S. Trolrier-McKinstry	Erdem Ozdemir
VI.9	4:46 – 4:49 Defects in Zn_{1-x}Mg_xO Films and Their Influence on Ferroelectric Properties for Energy-Efficient Non-Volatile Memory Applications - P. Yousefian, L.C. Jacques, R.J. Spurling, B. Akkopru-Akgun, D. Goodling, E. Ozdemir, J.-P. Maria, S. Trolrier-McKinstry, C.A. Randall	Pedram Yousefian



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Agenda

Thursday May 9, 2024

Session VII: Ceramic Processing Including Templated Grain Growth

GENERAL SESSION

Session Chair: Richard J. Meyer, Jr.

President's Hall 1 & 2

VII.1	8:00 – 8:15	Texture Development During the Sintering Process for Mn-PMN-PZT - M. Fanton, J. Fox, J. Peters, B. Weiland, R.J. Meyer, B. Watson	Mark Fanton
VII.2	8:20 – 8:35	Compositional Inhomogeneity in Textured Mn-doped PMN-PT-PZ: Thin vs Thick Cross-sections - G.T. Stranford, Z. Fan	Gerald T. Stranford
VII.3	8:40 – 8:55	Direct Ink Writing of Piezoelectric Ceramics: Process Scaling and Material Properties - C.D. Eadie, J. Lindau B. Watson, M. Fanton	Christopher Eadie
VII.4	9:00 – 9:15	Thermal Characterization and Design of Transducers using Textured Ceramics - C. Mangeot, G. Stranford, E. Ringgaard	Charles Mangeot
VII.5	9:20 – 9:35	Charting The Design Space for Textured PMN-PZ-PT Piezoceramics - A.E. Gurdal, D.L. McKnight, J. Getz, S. Tuncdemir	Ahmet Erkan Gurdal
	9:40 – 10:20	Morning Break	
VII.6	10:20 – 10:35	Reactivity of PMN-PZT in an Aqueous Suspension - C.A. Fellabaum, C.D. Eadie, B.H. Watson III, M.A. Fanton, R.J. Meyer Jr.	Chloe Fellabaum
VII.7	10:40 – 10:55	<001> Textured Lead-Free Piezoelectric Ceramic with Controlled Electrical Loss - A. Nanda, N. Lanagan, B. Poudel, S. Priya	Aman Nanda
VII.8	11:00 – 11:15	Properties of Ferroelectric Materials Under Cryo Conditions - T. Scholehwar, J. Homberg, B. Koc	Timo Sholehwar
VII.9	11:20 – 11:35	Processing and Optimization of Ferroelectric 95/5 PZT Ceramics - B.H. Watson, III, M.A. Fanton N. Sherlock, C. DiAntonio	Beecher H. Watson, III
VII.10	11:40 – 11:55	Grain Size Dependence on Enhanced Piezoelectric Properties of BaTiO₃ Ceramics by AC Poling Treatment Above Curie Temperature - A. Tsige, H. Nam, P. Sapkota, G.P. Khanal, Z. Wang, S. Ueno, S. Wada	Satoshi Wada
VII.11	12:00 – 12:15	Uniaxial Preload Stress Sensitivity of PZT and Textured Ceramic Transducer Materials - B.H. Watson, III, M.A. Fanton, S.J. Brumbaugh, E.L. Herrold, J. Peters, J.J. Fox, A. Walls, T.P. cleckner, R.J. Meyer Jr.	Beecher H. Watson, III