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Ferroelectricity Newsletter

A quarterly update on what's happening in the field of ferroelectricity

Volume 7, Number 1

Winter 1999

TOUCHING MANY BASES IN THE WORLDWIDE FERROELECTRIC COMMUNITY

When reporting on the triple Montreux conference in the last issue, we mentioned that what goes on around the official program of any scientific meeting can prove to be important not only for the advancement of knowledge in a particular field but also for science in general.

The feature article by **Professor Eric Cross**, ushering in the seventh year of the publication of the *Ferroelectricity Newsletter*, is entitled "**Changing conditions for younger scientists entering the ferroelectric field**" and stems from conversations during breaks in the official program of such gatherings, especially the IMF 9 in Seoul and the Montreux festival of conferences (Electroceramics VI, ECAPD IV, and ISAF 11) of last August.

It is true, Professor Cross addresses his observations and suggestions, culled from his experiences over a long academic career, to fledgling scientists in the ferroelectric field, but it does not take much imagination to apply his insights to other areas of scientific research. We thank Professor Cross for taking time out of his busy schedule to share his thoughts with us.

The major part of this issue is devoted to listing the titles and authors of presentations given at the **2nd Asian Meeting on Ferroelectrics International (AMF-2)** held 7-11 December 1998 at the Imperial Hotel in Singapore. For a concise overview of the conference, please turn to the summary report on page 17.

Over the last two decades, many members, old and new, of the ferroelectrics family have had the opportunity to be in contact – either by phone, fax, or in person – with **Alona S. Miller**, ISIF Coordinator in Colorado Springs. Many of you have probably heard the sad news that Alona died last fall. We miss her and we'll keep her memory in our hearts, with love and gratitude. You'll find more on Alona on page 21.

On page 18 you'll find news about the 30th anniversary of the **Ferroelectric Physics Department of the Institute of Solid State Physics at the University of Latvia** in Riga. And to fill the bowl of offerings to the rim, we bring you information about new books on electrets and some samples of articles in *Condensed Matter News* and *Sensors and Materials*.

We wish you health, happiness, success, and prosperity for 1999!

Rudolf Panholzer
Editor-in-Chief

IN THIS ISSUE

From the Editor	1
Feature	
Prof. Cross, "Changing conditions for younger scientists"	2
Papers	
AMF-2	4
Anniversary in Riga	18
Publications	
Electrets	19
Condensed Matter News	20
Sensors and Materials	21
Upcoming Meetings	
FWPR'99	22
FLC 99	23
EPS'99	23
Calendar of Events	24

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Volume 7, Number 1
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FEATURE

CHANGING CONDITIONS FOR YOUNGER SCIENTISTS ENTERING THE FERROELECTRIC FIELD

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Materials Research Laboratory
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University Park, PA 16802-4800

This short article stems from conversations with Rudy Panholzer following the IMF 9 and ISAF 11. At the conference in Seoul, during a brief invited review of the history and importance of the IMF sequence of conferences, given jointly with Dr. Jan Fousek, I remarked that conditions for young investigators entering our field were much inferior now to the conditions which I had when starting in the very late 1940s. Following the presentation, Rudy and I talked and he suggested it might be helpful to document some of the changes and perhaps encourage the power structure to move toward improvements in conditions, where these can be changed. This was further reinforced when we met again at the outstanding ISAF, ECAPD, ECR meeting in Montreux, so let me put some of these thoughts down on paper.

I believe the key ingredients for highly successful applied research programs, such as are required to move ferroelectricity forward, are **ideas, people, money, facilities, and industrial interest**, in that order.

It is my strong feeling, that in our subject, as in many others, the number of **ideas** generated by faculty members in a year are markedly down from where they used to be. One very good reason of course is that the frontier in the subject is now much farther away. How to cope with this problem? Perhaps give the younger faculty more time to formulate ideas and approaches? But no, that is not possible because most are chained to the tenure ladder with often 70 hour work weeks stuffed with departmental trivia, meetings, committees, new courses, etc., etc.

Ferroelectricity like many currently active areas absolutely demands interdisciplinary approaches, but

interdisciplinary faculty are in an even worse box. In our school, as in most others, they strive for tenure in departments, but they are a ““them,” not an “us” and have even steeper demands to satisfy.

Abolish tenure? An attractive idea which, however, I believe must be approached with caution. On the new playing field this would create, who is to be the judge of quality and performance? The administration? No! My guess is that the focus of administrative ire would be upon the few very active senior professors who act as “burrs under the saddle” for those who hold the reins of power.

When it comes to **people**, unfortunately the problem is even worse. Research is not where it is! Sport, entertainment, business, banking, law, and other money moving professions are what the media pronounce as kosher today. For the guy who struggles through to the graduate level, there is the penalty of the neglect of mathematics, physics, and chemistry in the lower levels of the American education system which often leaves a permanent handicap. In the past, local neglect was always more than made up by importing talent, but now the Immigration and Naturalization Service (INS) is watching like a hawk.

Policed by gems of our current political selection system, they constantly make it more difficult for the talented to come and more uncomfortable for them to stay. Do Mr. and Mrs. America really want this? I look at our own MRL at Penn State, and can trace more than \$50 million in federal funds brought into the local community over the last 25 years largely by imported talent.

Financially, I believe the country has continued to spend **money** on R&D at a marginally increasing rate, however, again the dollar amount per faculty year has certainly decayed and the Mickey Mouse and hoop jumping required to achieve success has massively increased. In the applied research agencies there appears to be a developing mania for micromanagement. I can still remember the halcyon days of the Office of Naval Research (ONR), where the program officer really had almost complete responsibility, decisions could be made in a snap, the system worked largely on trust, and we did not have the computing horsepower to keep minute-by-minute, halfpenny-by-halfpenny running accounts. What a joy to

FEATURE

do research in that climate! Could it return? I believe not in the federal system. With the burgeoning budgets of the private foundations, however, it might be possible if they could be persuaded of the importance of continuing applied research to the citizens. Probably the most immediate threat to ferroelectrics is the rapid rundown of the Department of Defense (DoD) agency budgets: ONR, Army Research Office (ARO), Air Force Office of Scientific Research (AFOSR), all looking at 15 to 20 percent cuts annually; only Defense Advanced Research Projects Agency (DARPA) is keeping up.

With no credible threat on the immediate horizon, one might have expected blossoming R&D to concentrate on over the horizon needs, however, such is not the present case. The National Science Foundation (NSF) builds budget continuously for basic research and this is good, but our own situation does perhaps suggest the need for a national technology foundation to address applied research needs and problems.

Instrumentation is the one area that I believe has improved markedly over time. The capability of the newer characterization tools, and the convenience of the new command and control software packages take much of the tedium out of data gathering, and gives access to levels of understanding which were impossible in earlier times. It is true that costs are frequently staggering and that many of the more sophisticated systems require full-time technician or technologist attention. Such is often beyond the range of individual junior faculty, but for a good problem, arrangements can be made with colleagues and friends at national resource facilities, national labs, and other centers. Clearly, the days of full local capability are numbered, and we will soon all be in the mode of "trading" unique capabilities to cover the needs of modern problem solving. In this arena, my caution to younger faculty would be to avoid becoming "machine minders." When you begin to think of problems in terms of their potential to be addressed by your machine, it is time to move on and out from under it!

Perhaps the saddest part of the whole story is the demise of research across much of US **industry**. There was a time when even mid-sized companies like Erie Technological and Sprague Electric (now both gone) used to boast of their research capability. In the case of Sprague, the quality was indeed very good, as attested by the fact

that many of the movers and shakers in university electroceramics are old Sprague alumni. Now, however, since some companies have demonstrated that it is cheaper to buy technology than invent it, and that it is even cheaper to fabricate offshore, most industrial labs are a shadow of their former selves. Now the CEOs keep quiet in case the shareholders spot another candidate to downsize and increase immediate profitability. In the present rather barren scene, how can younger faculty couple to industry and retain relevance in their applied research. I would believe the most effective catalyst is federal pass-through monies, which are of course still popular in industry. Larger fundings are in the DARPA-coupled programs and the Department of Commerce initiatives. For younger faculty, however, I would believe that Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) mechanisms are most important. With somewhat easier access conditions, since after all they are for business, SBIRs are a hot bed for applied research ideas, and can be a jumping-off point for related state programs. The benefit to the whole country is that they do aid in high tech employment and every now and then one does take off as a viable commercial development.

In summary, what could help the younger faculty?

1. Reconsideration of the tenure process, under careful scrutiny, particularly for interdisciplinary faculty.
2. Urgently needed improvements in lower level math and science education, and in the short run a return to a more open-door immigration policy for highly qualified younger scientists.
3. Persuasion of private foundations of the importance of applied research, to provide alternative funding. Return in DoD to longer-range research initiatives. Exploration of a national technology foundation.
4. Improved access to state-of-the-art instrumentation. Interchange between national or state centers for special needs.
5. A mandated funding, as in the SBIR, but tied to a consumer item, e.g., a one-cent tax on gasoline! Proceeds to generate joint industry/university applied research, as in the SBIR and STTR mechanisms.

AMF-2 PAPERS

2ND ASIAN MEETING ON FERROELECTRICS INTERNATIONAL (AMF-2)

The Second Asian Meeting on Ferroelectrics International took place 7-11 December 1998 in Singapore. In his message Professor Yao Xi, General Chairman, said, "The 350 contributions accepted by the AMF-2 for presentation are a clear indication and testimony to the region's active research and development, as well as the broad academic exchange and collaboration with the world ferroelectric community."

The AMF was initiated by the Asian Ferroelectric Association (AFA) in 1993. AMF-1 was held 5-8 October 1995 in Xian, China with 185 participants from 12 countries.

The proceedings of AMF-2 will be published in a special issue of **Ferroelectrics**.

The following is a listing of the titles and authors of papers presented at AMF-2.

FERROELECTRIC THIN FILMS

Depletion width in SrTiO₃ and Ba_xSr_{1-x}TiO₃ films.
J.F. Scott

A critical review of the effect of compositions, dopants, and orientation on the properties of PZT heterostructures for nonvolatile memories.

A.I. Kingon, S.K. Streiffer, and S.H. Kim

Laser-assisted PZT thin film fabrication.

Y.F. Zhu, and S.B. Desu

Preparation of bi-layered ferroelectric thin film by thermal MOCVD.

N. Nukaga, and H. Funakubo

Structural and electrical properties of SrTiO₃ thin film prepared by sol-gel technique.

H.O. Yadav

Time dependence of ferroelectric properties - basic physics and relevance for FERAM devices.

R. Waser, S. Tiedke, and O. Lohse

Temperature and voltage dependence in PZT ferroelectric thin film capacitors.

Y. Masuda, S. Fujita, A. Baba,

H. Masumoto, and T. Hirai

Physical properties of mixed BaTiO₃ thin film by RF-sputtering.

J.C. Shih, K.J. Ling, and C.S. Tu

Reactive ion etching of sol-gel derived PZT thin film and Pt/Ti bottom electrode for FRAM.

T.A. Tang, S.X. Zou, and N. Li

Photocurrent effect and fatigue characteristics of lead zirconate titanate thin film capacitors.

Y.S. Yang, B.G. Chae, and M.S. Jang

Interfacial reaction and control of Pt/PZT/Pt by sol-gel process.

A.L. Ding, W.G. Luo, P.S. Qiu, and K.S. No

Sputtered Ba_{0.5}Sr_{0.5}TiO₃ thin film capacitors on Pt and IR electrodes for DRAM applications.

P.Y. Chu, S. Zafar, B.E. White, Jr., M. Raymond, B. Melnick, B. Jiang, R.E. Jones, Jr., and M. Kottke

Ferroelectric (Ba,Sr)TiO₃ thin films by multi-target RF sputtering.

X.F. Chen, W. Zhu, O.K. Tan, and M.S. Tse

Optical waveguiding SrBi₂Ta₂O₉ thin films prepared by pulsed laser deposition.

J. Yin, W.F. Zhang, Z.C. Wu, Z.L. Wang, Y.Y. Zhu, J.M. Liu, and Z.G. Liu

Pulsed laser deposition (PLD) growth and study of barium strontium titanate thin films for high density DRAMs.

S. Saha, and S.B. Krupanidhi

Recent developments in ferroelectric thin films with layered structure.

S.B. Desu

High-rate deposition and process stability control of Pb(Zr,Ti)O₃ ferroelectric thin film sputtering for FRAM application.

K. Suu, T. Masuda, Y. Nishioka, and N. Tani

Direct integration of Pt/Ru bottom electrode on poly-Si metallorganic chemical vapor deposition for high-dielectric thin films.

Eun-Suck and S.G. Yoon

Synthesis, microstructure and electrical properties of hydrothermally prepared ferroelectric BaTiO₃ thin films.

W. Zhu, S.A. Akbar, R. Asiaie, and P.K. Dutta

Electrical properties of ferroelectric thin films for FRAM application.

H.G. Kim

AMF-2 PAPERS

Epitaxial $\text{Ba}_{0.5}\text{Sr}_{0.5}\text{TiO}_3/\text{LaNiO}_3$ heterostructure by pulse laser deposition

B. Yang, C.S. Xiao, X.Y. Chen, Y.F. Chen, Y.Y. Zhu, Z.G. Liu, and N.B. Ming

Synthesis and characterization of PZT ultrafine powder and thin films prepared by a novel low-temperature sol-gel process.

D.G. Liu, H.X. Zhang, and L.C. Zhao

Non-planar piezoelectric structures made by film technology.

S. Leppavuori, A. Kruusing, and A. Uusimäki

(Ba,Sr)TiO₃ thin films: preparation, properties, and reliability.

T.Y. Tseng

Pulsed laser deposition of PZT/YBCO, PZT/LSCO heterostructures for ferroelectric field effect transistor application.

J.M. Liu

Growth and electrical properties of strained (Ba,Sr)TiO₃ thin films.

S.J. Jun, and J.C. Lee

Optimization of thermal annealing process of lead lanthanum titanate ferroelectric films.

X.Q. Wu, W. Ren, Y.H. Mao, L.Y. Zhang, and X. Yao

Growth and micro-Raman study of RF magnetron sputtered deposited PbTiO₃ thin films

S. Srinivas, S. Bhaskar, A. Reyes-Figueroa, and R.S. Katiyar

Pulsed excimer laser ablation and study of anti-ferroelectric lead based perovskite thin films.

S.S.N. Bhardwaja, A.R. James, and S.B. Krupanidhi

Properties of micropatterned ferroelectric thin films fabricated by electron beam exposed sol-gel process.

S. Okamura, and T. Shiosaki

Correlations between morphological and electrical characteristics of Pt/SrBi₂Ta₂O₉/CeO₂/Si capacitors.

H.N. Lee, and S.H. Choh

Sol-gel derived ferroelectric thin films of LiTaO₃ on SiO₂/Si substrate

S.D. Cheng, C.H. Kam, Y. Zhou, Y.L. Lam, Y.C. Chan, K. Pita, and W.S. Gan

Epitaxial PLT thin films prepared by sol-gel processing.

Q.F. Zhou, L.W. Chan, Q.Q. Zhang, and C.L. Choy

MOCVD and properties of 15-100 nm films in the Ba-Sr-Ti-O system.

S.K. Dey

Effect of substrate temperature on ferroelectric properties of (Pb_{1-x}La_x)TiO₃/SrRuO₃ thin films.

Y.K. Tseng, K.S. Liu, J.D. Jiang, and I.N. Lin

Fabrication and structural properties of sol-gel derived

Sr_{0.6}Ba_{0.4}Nb₂O₆ (SBN60) films.

C.H. Luk, C.L. Mak, K.H. Wong

Effects of (100)-textured LaNiO₃ oxide electrode on the structure and electrical properties of

Sr_{0.8}Bi_{2.4}Ta₂O₉ thin films.

G.D. Hu, I.H. Wilson, J.B. Xu, G.S. Huang, W.Y. Cheung, E.Z. Luo, N. Ke, and S.P. Wong

Substrate effect on Pb_{0.6}Sr_{0.4}TiO₃ thin film growth by pulsed laser deposition.

C.S. Hou, C.C. Chou, and H.F. Cheng

Structural and properties of (Pb,Ca)TiO₃ thin films derived by sol-gel process.

X.G. Tang, Q.F. Zhou, and J.X. Zhang

Preparation of lead-zirconate-titanate thin films on silicon by using a novel technique at low temperature.

J.M. Zeng, M. Zhang, J.X. Gao, X.Z. Duo, L.S. Ni, L.W. Wang, and C.L. Lin

Characterization of Nb-doped SrBi₂O₉ ferroelectric thin films.

P.X. Yang, and J.H. Chu

Barium strontium titanate thin films derived by a sol-gel technique.

D.H. Bao, L.Y. Zhang, and X. Yao

Composition characterization of PB(Zr,Ti)O₃(PZT) thin films prepared by pulsed laser deposition.

X.Y. Chen, J.M. Liu, and Z.G. Liu

Asymmetric rocking curve study of the crystal structure orientations for BaTiO₃ thin films grown by pulsed laser deposition.

Z.H. Chen, C.L. Li, D.F. Cui, Y.L. Zhou, and H.B. Lu

Influence of pre-firing on the properties of ferroelectric Bi₄Ti₃O₁₂ thin films prepared by metalorganic decomposition.

X.S. Wang, L.B. Kong, L.Y. Zhang, and X. Yao

AMF-2 PAPERS

Size effect of nano-crystalline PZT/PT ferroelectric thin films.

M.D. Tao, S.G. Song, X.R. Fu, G.M. Wu, and C.L. Lin

Processing and properties of excimer laser deposited PMN-PT thin films.

S.S.N. Bharadwaja, A.R. James, and S.B. Krupanidhi

Microstructure features of $\text{Pb}(\text{Zr}_x\text{Ti}_{1-x})\text{O}_3/\text{YBa}_2\text{Cu}_3\text{O}_{7-x}/\text{SrTiO}_3$ heterostructure.

O. Jin, D.L. Wang, and L. Li

Pulsed laser deposition and study of $\text{SrBi}_2\text{Ta}_2\text{O}_9$ (SBT) thin films.

S.S.N. Bharadwaja, A.R. James, and S.B. Krupanidhi

Electrical properties of ferroelectric $(\text{Ba,Sr})\text{TiO}_3$ thin film with and without SrTiO_3 buffer layer on Si substrate by DC-unbalanced magnetron sputtering.

A. Fuad, and M. Barmawi

The role of ultrathin SiO_2 buffer layer on growth of highly C-axis oriented $\text{Pb}(\text{Zr,Ti})\text{O}_3$ thin films on Si.

Y. Lin, H.B. Peng, and B.R. Zhao

Ferroelectric $(\text{Ba,Sr})\text{TiO}_3$ thin films by sol-gel techniques and its characterisation.

N.V. Giridharan, R. Jayavel, and P. Ramasamy

Domain structure and polarization reversal in $\text{SrBi}_2\text{Ta}_2\text{O}_9$ thin films studied at nanoscale.

A. Gruverman

RELAXOR**FERROELECTRICS**

Influence of relaxor character on lower temperature ferroelectric behavior.

L. Eric Cross

Morphotropic phase boundaries in ferroelectric tungsten bronze.

R.Y. Guo

Piezoelectric properties of relaxor based ceramics.

F. Xia, and X. Yao

Study of non-stoichiometrical micro-domains in relaxor ferroelectric $\text{Pb}(\text{Mg}_{1/3}\text{Nb}_{2/3})\text{O}_3$ (PMN) ceramic material.

C.D. Feng, Y.Y. Li, C.L. Zhao, C.G. Li, and Z.W. Yin

Dielectric properties of $\text{Pb}(\text{Mg}_{1/4}\text{Zn}_{1/4}\text{W}_{1/2})\text{O}_3$ ceramics.

S.K. Sinha, S.N. Choudhary, K. Prasad, and R.N.P. Choudhary

B-site ordering and dielectric relaxation properties of lead magnesium niobate.

X.Y. Li, C.D. Feng, and C.G. Li

A new glass model of ferroelectric relaxors.

X. Yao, Z.Y. Cheng, and L.Y. Zhang

$\text{Ba}(\text{Zn}_{1/3}\text{Nb}_{2/3})\text{O}_3$ ceramics synthesized by spray pyrolysis technique.

M.H. Liang, C.T. Hu, H.Y. Chang, and I.N. Lin

Raman scattering study of $0.91\text{Pb}(\text{Zn}_{1/3}\text{Nb}_{2/3})-0.09\text{PbTiO}_3$ relaxor ferroelectric crystals.

F.M. Jiang, S. Kojima, and Y. Yamashita

On enhancing the relaxor behavior in $\text{Ba}(\text{X}_{1/3}\text{Nb}_{2/3})\text{O}_3$ perovskites.

A.J. Ranade, N.G. Durge, and S.V. Salvi

Phase transitions due to polar region structure in disordered relaxor ferroelectrics.

H.Q. Fan, L.Y. Zhang, and X. Yao

Light scattering spectroscopy of relaxor ferroelectrics.

L.G. Siny, S.G. Lushnikov, and R.S. Katiyar

The phase transition and domain structures in PMNT relaxor ferroelectric single crystals.

G.S. Xu, H.S. Luo, and Z.W. Yin

Dielectric properties of relaxor ferroelectric materials obtained by hydrothermal processing.

A. Dias, V.T.L. Buomo, and V.S.T. Ciminelli

Aging mechanisms of dielectric dispersion in lead based perovskite relaxor ferroelectrics.

H.Q. Fan, L.Y. Zhang, and X. Yao

Dielectric and piezoelectric properties of PZN-PMN-PT ceramics.

F. Xia, and X. Yao

Time and frequency domain dielectric spectrum of $\text{Sr}_x\text{Ba}_{1-x}\text{TiO}_3$ ceramics.

D.M. Lei, J.D. Li, Z.Q. Li, and C.D. Fang

Study on ferroelectric phase transition of PMN-PT single crystals.

P.C. Wang, H.A. Luo, D.L. Li, and W. Shen

AMF-2 PAPERS

Studies on ferroelectric, piezoelectric properties and strain vs E-field behavior for PMN-PT single crystals.

X.W. Huang, H.S. Luo, G.S. Xu, Z.Y. Qi, H.Q. Xu, and Z.W. Yin

Growth and characterization of relaxor ferroelectric PMNT single crystals.

H.S. Luo, G.S. Shen, P.C. Wang, and Z.W. Yin

Thickness dependence of hydrostatic piezoelectric properties of 1-3 piezoelectric composites.

D.H. Li, and X. Yao

Growth and characterization of relaxor ferroelectric lead iron niobate single crystals.

S. Venkataraj, R. Jayavel, and P. Ramasamy

Studies on diffused phase transition behavior of barium calcium titanate single crystals.

R. Varatharajan, R. Jayavel, C. Subramanian, and P. Ramasamy

DI-, PIEZO-, & PYROELECTRIC PROPERTIES

Compact piezoelectric ultrasonic motors.

K. Uchino, and B. Koc

Properties of sputter and sol-gel deposited PZT thin films for sensor and actuator applications: preparation, stress and space charge distribution self poling.

G. Gerlach, G. Suchaneck, R. Kohler, T. Sandner, J. Frey, A. Schonecker, R. Krawietz, and W. Pompe

Dielectric properties of the $\text{Pb}(\text{In}_{1/2}\text{Nb}_{1/2})\text{O}_3$ - PbTiO_3 single crystal.

N. Yasuda, H. Ohwa, K. Ito, M. Iwata, and Y. Ishibashi

Pyroelectric and piezoelectric studies on BSKNN ceramics.

Rao K.S. Sambasiva

Piezoelectric properties and hydrostatic receiving characteristics of 0-3 composites.

H. Banno

Wide frequency range dielectric properties of related BaTiO_3 ceramics sintered with the aid of fluorine additives.

C. Elissalde, A. Simon, A. Villesuzanne, and J. Ravez

Dielectric properties of Cs_2CdI_4 and Cs_2HgI_4 .

F. Shimizu, M. Takashige, and T. Kurihama

Dielectric hysteresis measurement in lossy ferroelectrics.

J.H. Park, B.K. Kim, J.G. Park, and I.T. Kim

Temperature-uniaxial pressure phase diagram of CsLiSO_4 .

I. Guedes, F.E.A. Melo, C.W.A. Paschoal, P.T.C. Freire, and J. Mendes-Filho

Dielectric relaxations and collective effects in nominally pure, single- and double-doped KTaO_3 .

V. Trepakov, M. Savinov, V. Vikhnin, S. Kapphan, P. Syrnikov, H. Hesse, and L. Jastrabik

Microwave dielectrics of the third kind for tunable devices.

A. Bhalla

Li-induced ferroelectricity and its structural phase transition in ZnO

A. Onodera, K. Yoshio, H. Satoh, T. Takama, M. Fujita, and H. Yamashita

Temperature-electric field phase diagram of KH_2PO_4 .

E.F. Bezerra, A.T. Varela, N.M. Barbosa-Neto, F.E.A. Melo, P.T.C. Freire, and J. Mendes-Filho

Preparation, structure, and PTC property of manganese-doped barium titanate.

W. Wang, X.Q. Han, J.P. Zhao, D.G. Liu, L.S. Qiang, H.X. Zhang, and C.Q. Xu

The effect of MnO additions on the dielectric and piezoelectric properties of lead zirconate titanate ceramic material doped with Nb_2O_5 .

J. Singh, N.C. Soni, and V. Singh

Piezoelectric properties of some lead-free ferroelectric ceramics.

T. Takenaka

Dielectric response on the transition from $x\text{BaTiO}_3$ -(1-x) SiO_2 glass to crystal.

J.E. Kim, J.H. Cho, S.J. Kim, and Y.S. Yang

Phases in antiferroelectric-side $\text{Rb}_{1-x}(\text{ND}_4)_x\text{D}_2\text{AsO}_4$ mixed crystals.

C.S. Tu, and V. Hugo Schmidt

$\text{Ba}(\text{Mg}_{1/3}\text{Ta}_{2/3})\text{O}_3$ ceramics with different raw materials.

M.Y. Zhao, J.J. Bian, and Y. L. Wang

The history of pyroelectricity. From ancient Greece to space missions.

AMF-2 PAPERS

S.B. Lang

Generation of higher harmonic voltages in piezoelectric ceramics.
H. Igarashi, K. Ishii, N. Akimoto, and S. Tashiron

Effect of vanadium doping on the dielectric, pyroelectric, and piezoelectric properties of $\text{Pb}(\text{Mg}_{1/3}\text{Ta}_{2/3})\text{O}_3$ - PbTiO_3 ceramics.
J.M. Jung, G.B. Kim, H.S. Lee, and S.W. Choi

Microwave dielectric study of RS-ARS mixed crystals.
A. Oka, R. Nozaki, and Y. Shiozaki

The characterization of strain V.S field and crystal structure for PBNN piezoelectric ceramic with tungsten bronze structure.
D.R. Chen, G.R. Li, and Q.R. Yin

An investigation on dielectric loss associated with the viscous motion of domain wall in $\text{Pb}(\text{Zr}_{0.52}\text{Ti}_{0.48})\text{O}_3$ ceramics.
X.B. Chen, M. Jiang, Y. Din, F. Yan, J.S. Zhu, and Y.N. Wang

Study of pyroelectric and relaxation phenomena in PVDF/PMMA blends.
K.T. Yu, J.S. Lim, E. Lim, and G.S. Park

Local piezoelectric properties of ferroelectric $\text{Sr}_{0.8}\text{Bi}_{2.4}\text{Ta}_2\text{O}_9$ thin films prepared by metalorganic decomposition.
G.D. Hu, G.S. Huang, J.B. Xu, I.H. Wilson, W.Y. Cheung, E.Z. Luo, N. Ke, and H.K. Wong

Specific heat study in II-VI semiconductor $\text{Cd}_{1-x}\text{Mn}_x\text{Te}$.

A. Onodera, C.C. Myint, Y. Kawamura, H. Satoh, and K. Matsuki

Effects of the deposited factors on the deposition rate of PZT thin film prepared by the nebulized spray pyrolysis.

G.M. Wu, S.G. Song, X.R. Fu, M.D. Tao, and C.L. Lin

Investigation of conductivity and dielectric permittivity of CuSnSbS_3 in temperature region of 78-400K.

O.L. Kobeleva, Ya.L. Kobelev, V.B. Zlokazov, V.L. Kobelev, N.V. Melnicova, and L. Ya Kobelev

The dielectric and electromechanical properties of lead barium niobate at different Pb/Ba ratio.
J. Singh, V. Singh, and N.C. Sonic

Dielectric response of sol-gel PZT films.
R.P. Tandon

Effect of excess PbO on the dielectric, pyroelectric, and piezoelectric properties of $0.7\text{Pb}(\text{Mg}_{1/3}\text{Ta}_{2/3})\text{O}_3$ - 0.3PbTiO_3 ceramics.
J.M. Jung, G.B. Kim, H.S. Lee, and S.W. Choi

Research on high temperature piezoelectric properties of modified PbNb_2O_6 .
C.G. Li, J.M. Xue, J.G. Zhou, H.Y. Ni, and J.H. Chen

Tunable pyroelectricity in La-modified PZST antiferroelectric ceramics.
T.Q. Yang, P. Liu, Z. Xu, L.Y.

Zhang, and X. Yao

Electrical conductivity of bismuth layer structured $\text{SrBi}_4\text{Ti}_4\text{O}_{15}$ and $\text{SrBi}_4\text{Ti}_{4-3x}\text{Fe}_{4x}\text{O}_{15}$.
T. Bhima Sankaram, G.S. Kumar, G. Prasad, and S.V. Suryanarayana

Effect of non-stoichiometric composition on the sinterability, microstructure and microwave dielectric properties of $\text{Ba}(\text{Mg}_{1/3}\text{Ta}_{2/3})\text{O}_3$.
J.J. Bian, M.Y. Zhao, and Z.W. Yin

Pure phase $\text{Ba}_2\text{Ti}_9\text{O}_{20}$ ceramics prepared by conventional processing.
Y. Yao, W.J. Wu, and M.Y. Zhao

Dielectric and pyroelectric properties of samarium substituted PLZT.
C. Prakash, O.P. Thakur, and P. Kishan

Conductivity and dielectric studies on flux grown KTiOPO_4 single crystals.
S. Ganesa Moorthy, F. Joseph Kumar, C. Subramanian, and P. Ramasamy

CRYSTALS AND CERAMICS

Growth, characterization, and properties of relaxor ferroelectric PMN-PT single crystals.
Z. Yin, H.S. Luo, P.C. Wang, and G.S. Xu

Domain structures and phase transitions of relaxor-based ferroelectric single crystals.
Z.G. Ye

Even and odd effect and crystal

AMF-2 PAPERS

structure in $C_nH_{2n+1}NH_3H_2PO_4$ crystals.

H. Kasatani, M. Iwata, H. Terauchi, and Y. Ishibashi

TSSG growth and optical characteristics of V-doped KLN crystals.

X.W. Xu, T.C. Chong, L. Li, H. Kumagai, and M. Hirano

Studies on the conductivity of ceramics $LaFe_{1-x}Ni_xO_3$ -alpha.

C.J. Wang, J.H. Wei, Y.X. Chen, D.S. Liu, H.S. Zhao, and C.P. Li

Microstructural and piezoelectric properties on modified barium silver niobate ceramics.

Rao K.S. Sambasiva, and Rao M. Rajeswara

Microstructured ferroelectrics and its physical effects.

N.B. Ming, and Y.Y. Zhu

Preparation of temperature stable $Pb(Ni_{1/3}Nb_{2/3})O_3$ -based biphasic ceramics.

Z.R. Li, L.Y. Zhang, and X. Yao

Phase transitions in $(CH_3NH_3)_{1-x}Bi_{2(1-x)}Sb_{2x}Br_9$ mixed crystals.

M. Iwata, A. Miyashita, H. Orihara, Y. Ishibashi, M.H. Kuok, Z.L. Rang, and S.C. Ng

Growth and light-induced absorption in ferroelectric photorefractive (V,Cr)-doped $(KNa)_{0.1}$

$(Sr_{0.75}Ba_{0.25})_{0.9}Nb_2O_6$ crystals.
Y.L. Zhang, E.Y.B. Pun, P.S. Chung, and D. Mo

Effect of SiO_2 and B_2O_3 on structure and dielectric properties of Bi_2O_3 - $ZnO-Nb_2O_5$ based ceramics.

H. Wang, and X. Yao

Structural and dielectric properties of lanthanum modified barium lithium niobate ceramics.

Rao K.S. Sambasiva, Rao K. Koteswara, T.N.V.K.V. Prasad, and Rao M. Rajeswara

Lead-free piezoelectric ceramics of $(Bi_{1/2}Na_{1/2})TiO_3$ - $BiFeO_3$ system.

H. Nagata, N. Koizumi, and T. Takenaka

The effect of annealing atmosphere on structure characteristics of magnesium diffused lithium niobate single crystal substrates.

W.X. Que, L.Y. Zhang, X. Yao, Y. Zhou, Y.L. Lam, Y.C. Chan, and C.H. Kam

Studies of the perovskite rare earth oxide conductive ceramics.

C.J. Zhang, C.J. Wang, M.S. Xiao, H. Mashiyama, and H. Kasano

Effect of substitution Pb by Ba on electric properties and structures of $(Pb_{0.97}La_{0.02})(Zr/Ti/Sn)O_3$ ceramics.

P. Liu, Z. Xu, T.Q. Yang, L.Y. Zhang, and X. Yao

Low-temperature preparation and characterization of $PbTiO_3$ ceramics.

D.S. Yu, L.S. Qiang, H.X. Zhang, and C.Q. Xu

Growth and ferroelectric studies on $KLiNbO_3$ single crystals.

Rao A.V. Prasada, and M. Suresh

The synthesis, structure, and dielectric properties of $Bi_{1.5-x}La_xZnNb_{1.5}O_7$ based ceramics.

X.K. Cai, D.S. Zhang, Y.P. Liu, L.Y. Zhang, and X. Yao

Influence of additive Nb_2O_5 on phase transition in PZT 95/5 ceramics.

D.Z. Sun, Q.H. Jin, D.W. Yu, C.F. Qu, C.H. Yao, and S.W. Lin

Influences of nanometer inhomogeneity on the phase transition & PTC effect in doped $BaTiO_3$ ferroelectric ceramics.

S.G. Lu, L.Y. Zhang, and X. Yao

Uniform macroporous materials by emulsion templating.

H. Wei, X.Y. Lei, F. Ding, and N.B. Ming

Influence of $BaPbO_3$ doping on properties of $Ba(SnSb)O_3$ ceramics.

D.X. Zhou, S.L. Jiang, S.P. Gong, and X.H. Wang

Microstructural, dielectric and resistivity studies on modified barium titanium niobate ceramics.

Rao K.S. Sambasiva, and Rao M. Rajeswara

Effect of $Bi_4Ti_3O_{12}$ -doped on the electric properties of low voltage ZnO varistor.

T.J. Zhang, D.X. Zhou, S.L. Jiang, and S.P. Gong

Lanthanum and neodymium dititanates from coprecipitated oxalate and hydroxide precursors.

Rao A.V. Prasada, and M. Suresh

Growth and device characterization on amino mixed TGS crystals.

G. Ravi, A.S. Haja Hameed, and P. Ramasamy

Effect of dispersing agent on the distribution of PCLT nanocrystalline powder in PCLT/

AMF-2 PAPERS

P(VDF-TrFE) composites.

Q.Q. Zhang, H.L.W. Chan, Q.F. Zhou, and C.L. Choy

Microstructures and photoluminescence of the nanophase Ce-doped barium titanate.

M.S. Zhang, M.H. Chen, Q. Chen, W.C. Chen, and Z. Yin

Preparation of ZnS/Ormosils nanocomposites and their optical properties.

X.P. Zou, L.Y. Zhang, and X. Yao

Effects of thermal treatments on microstructure and magnetic properties of spinel NiFe_2O_4 nanocomposites.

G.S. Li, M.Q. Wang, L.P. Li, S.H. Feng, and X. Yao

Studies on new modified PbTiO_3 piezoelectric ceramic materials.

T.S. Zhou, Y.B. He, X.Z. Zhang, Y.W. Zhang, A.X. Kuang

Effect of SiO_2 additive on the mechanical and dielectric properties of PZFNTO ceramics.

H.T. Huang, and P. Hing

Growth characterization and properties of ferroelectric bismuth thiourea chloride crystals.

S.M. Dharmaprakash, and S.G. Bhat

Preparation of lead titanate ferroelectric ceramics by improved sol-gel method.

J.Y. Huang, H.G. Fu, Z.L. Ding, L.C. Hong, C.Q. Xu, and H.X. Zhang

Syntheses, growth, and characteri-

sation of bismuth tellurite (Bi_2TeO_5) crystals.

S. Kumaragurubaran, D. Krishnamurthy, C. Subramanian, and P. Ramasamy

Dielectric studies in cellulose acetate-polyvinyl acetate polymer blend films.

A.K. Sharma, and D.S. Sagar

Crystal growth of potassium hydrogen phthalate: A molecular-ionic crystal with electrooptic properties.

K. Srinivasan, R. Dhanasekaran, and P. Ramasamy

PROCESSING

Solid freeform fabrication of novel piezoelectric ceramics and composites for transducer applications.

A. Safari, and S.C. Danforth

PLZT ceramics prepared from conventional and microwave-hydrothermal powders.

S.F. Liu, I.R. Abothu, S. Komarneni, and D.S. Paik

The microstructure dependence on processing temperature in sol-gel derived thin ferroelectric films of LiNbO_3 on SiO_2/Si substrate.

S.D. Cheng, C.H. Kam, Y. Zhou, Y.L. Lam, Y.C. Chan, W.S. Gan, and K. Pita

Effects of heat treatment under atmosphere on the PTCR properties of BaTiO_3 thermistors.

D.X. Zhou, S.L. Jiang, S.P. Gong, and X.H. Wang

$(\text{Pb,Lu})(\text{Zr,Ti})\text{O}_3$ thick films - processing and dielectric properties.

M. Kosec, J. Holc, B. Malie, and V. Bobnar

Low-temperature processing of $\text{Pb}\{(\text{Mg}_{1/3}\text{N}_{2/3})_{0.9}\text{Ti}_{0.1}\}\text{O}_3$ thin films by sol-gel casting.

H. Suzuki, H. Masui, T. Ota, and M. Takahashi

Electrical properties of ZnO varistors prepared by 24 GHz microwave sintering process.

W.C. Lee, K.S. Liu, M.W. Wu, and I.N. Lin

Pulsed laser deposition of ZnO as conductive buffer layer of (001)- LiNbO_3 thin films.

J.M. Liu

Improved PZT 95-5 type ferroelectric ceramics for charge storage devices.

S.W. Lin, C.F. Qu, C.H. Yao, Q.H. Jin, and D.Z. Sun

Surface analytical studies of metal-PZT ceramics interfaces formed by various metallization methods.

A.A. Yerofeyev, F.F. Legusha, S.I. Pugachev, Y.A. Kudriavtsev, and V.S. Strykanov

Fabrication and characterization of piezoelectric PZT thick films using partial melts.

K.S. No, Y.B. Jeon, C.H. Lee, and J.S. Chung

CSD process with water-based precursor solutions for BST thin films.

W.G. Luo, A.L. Ding, X.Y. He, P.S. Qiu, X.H. Pu, and K.S. No

Enhancing the densification process on $\text{Ba}(\text{Mg}_{1/3}\text{Ta}_{2/3})\text{O}_3$ microwave dielectrics by Y_2O_3 incorporation.

M.H. Liang, C.T. Hu, H.Y. Chang, and I.N. Lin

AMF-2 PAPERS

Oriented PZT ferroelectric thin film prepared by nebulized spray pyrolysis.

G.M. Wu, S.G. Song, X.R. Fu, M.D. Tao, and C.L. Lin

PZT thin films formation by RF magnetron sputtering.

V.M. Ievlev, A.I. Spirin, D.M. Darinskii, Y.A. Obvintsev, and B.L. Agapov

Nanocomposite versus monophasic sol-gel processing of PLZT (3/52/48) ceramics.

I.R. Abothu, Y. Ito, S. Komarneni, and K. Uchino

On the microwave sintering technique applied for enhancing the properties of semiconducting PTC resistors and ZnO varistor.

I.N. Lin

Processing of sol-gel derived $\text{Pb}_x\text{La}_{1-x}(\text{Zr}_y\text{Ti}_{1-y})\text{O}_3$ thin films.

T. Hirano, H. Kawai, H. Suzuki, S. Kaneko, and T. Wada

Fabrication and characterization of sol-gel derived $(\text{K}_x\text{Na}_{1-x})_{0.4}(\text{Sr}_{0.6}\text{Ba}_{0.4})_{0.8}\text{Nb}_2\text{O}_6$ (KNSBN).

B. Lai, C.L. Mak, and K.H. Wong

Photoluminescence of barium titanate ultrafine particles prepared by hydrothermal process.

J. Yu, W.F. Zhang, and M.S. Chen

Environmentally conscious ferroelectrics research - past and present.

D.Q. Xiao

Binder coagulation casting of ferroelectric components.

W.J. Walker, D.K. Chatterjee, and S.K. Ghosh

Synthesis of dielectric perovskite titanate $\text{La}_{0.58}\text{Ag}_{0.26}\text{TiO}_3$.

Y.J. Shan, N. Kato, T. Nakamura, Y. Inaguma, and M. Itoh

Study of the formation mechanism of sol-gel derived strontium barium niobate powders using raman spectroscopy and X-ray diffractometry.

M.M.T. Ho, C.L. Mak, and K.H. Wong

Incipient flocculation molding - a new ceramic forming technique.

S. Arrasmith, S.K. Ghosh, and D.K. Chatterjee

Electrical properties of direct deposited piezoelectric thick film formed by gas-deposition method.

J. Akedo, N. Minami, K. Fukuda, M. Ichiki, and R. Maeda

Direct wafer bonding and layer transfer - a new approach to integration of ferroelectric oxides into silicon technology.

M. Alexe, A. Pignolet, D. Hesse, and U. Gosele

A new mechanism for the influence of electroplating and electroless plating on ferroelectric components.

L.T. Li, W.P. Chen, and Z.L. Gui

The role of BaCO_3 -CuO processing in low-fire Y5V $(\text{Ba,Ca})(\text{Zr,Ti,Sn})\text{O}_3$ dielectric compositions.

S.Y. Chen

Addition of a novel ferroelectric member $\text{Ag}_{1/2}\text{Bi}_{1/2}\text{TiO}_3$ to the perovskite titanate family ATiO_3 and $\text{A}'_{1/2}\text{A}''_{1/2}\text{TiO}_3$.

T. Nakamura, Y.J. Shan, Y. Inaguma, and M. Itoh

PROCESSING AND SURFACE

The internal friction study on $\text{SrBi}_2\text{Ta}_2\text{O}_9$ ceramic.

F. Yan, J.S. Liu, X.B. Chen, Z.G. Zhang, Z. Yang, J.S. Zhu, and Y.N. Wang

Surface reconstruction in TGS single crystal with humidity and temperature controls: A wet SPM study.

S. Balakumar, and H.C. Zeng

The crystallinity and the surface morphology of sol-gel derived thin films of BaTiO_3 on SiO_2/Si substrate.

S.D. Cheng, C.H. Kam, Y. Zhou, Y.L. Lam, Y.C. Chan, and K. Pita

Total dose radiation effects of Pt/PZT/Pt ferroelectric capacitors fabricated by PLD method.

J.X. Gao, L.R. Zheng, and C.L. Lin

Interface states and dependence of ferroelectric properties on frequency for PZT thin film prepared by sol-gel processes.

S.G. Song, M.D. Tao, X.R. Fu, G.M. Wu, and C.L. Lin

The heterojunction effect of ferroelectric thin films on Pt electrodes.

L.B. Huang, S.S. Liu, S.H. Mei, and Z.H. Wu

Dielectric, ferroelectric properties of $\text{KTa}_{0.65}\text{Nb}_{0.35}\text{O}_3$ thin films prepared by sol-gel process on Pt/Ti/MgO(100) substrates.

S.M. Wang, G.S. Zhang, Z.Y. Li, and D.M. Zhang

AMF-2 PAPERS

Ultrasonic forming of piezoceramic.

A.A. Yerofeyev, F.F. Legusha, S.I. Pugachev, and N.G. Semenova

ZnO and MnO₂ doped PbTiO₃ ceramics prepared by the sol-gel method.

L.S. Qiang, J.B. Zhang, D.S. Yu, H.X. Zhang, and C.Q. Xu

THEORY & FUNDAMENTALS

Theory of thickness transition of ferroelectric thin films.

Y. Ishibashi, H. Orihara, D.R. Tilley

Prediction of ferroelectric properties in niobates and tantalates based on covalency considerations.

C. Elissalde, A. Villesuzanne, and J. Ravez

Bond geometry, collective proton ordering, and coexistence of order/disorder and displacive dynamics in hydrogen-bonded ferroelectrics.

A. Bussmann-Holder, and K.H. Michel

Theoretical analysis of optimal QPM-SHG waveguide structure on LiTaO₃ substrates.

P.F. Hu, T.C. Chong, L.P. Shi, and W.X. Hou

Phase transition properties of ferroelectric thin films with diluted surfaces.

C.L. Wang, L. Zhang, W.L. Zhong, and P.L. Zhang

Phase transition in

K₂Fe(SO₄)_{2.2}H₂O.

H. Ishigami, and M. Sumita

Ferroelectric particles described by the transverse Ising model.

W.L. Zhong, Y.G. Wang, and P.L. Zhang

Semiempirical Hartree-Fock calculations for single and interacting Li impurities in KTaO₃.

R.I. Eglitis, A.V. Postnikov, and G. Borstel

A model for polarization switching in layered ferroelectric structures.

S.R.P. Smith

Size effect in ferroelectric thin film.

J.S. Zhu, and Y.N. Wang

Landau theory of ferroelectric films with asymmetric behavior.

Y.P. Peng, C.L. Wang, L. Zhang, P.L. Zhang, and W.L. Zhong

MO study of behavior of a spontaneous polarization vector near a surface and a point defects in crystals.

B.M. Darinskii, and D.S. Sajko

Structural modulation in perovskite-like cuprates.

S. Kuwata, and K. Terada

Local structural distortions, discommensurations, stripes, and precursor domains in ferroelectric perovskites.

A. Bussmann-Holder

Monte-Carlo simulation of the P-E hysteresis and domain switching in ferroelectric potts lattice.

J.M. Liu

Two-dimensional electron-hole

system in incommensurate state.

W. Kinase, K. Harada, and K. Ohi

Phase transition of pyrochlore structure in Bi₂O₃-ZnO-Nb₂O₅ system.

H. Wang, and X. Yao

Phase transitions in K₂Mn₂(SO₄)₄ langbeinite.

T. Hikita, M. Tanimoto, A. Onodera, and H. Iwanaga

The coupling between electric field and elastic stress in the incommensurate phase.

H.Y. Ahn, Y.C. Cho, S.E. Park, and S.Y. Jeong

Impurity-induced phase transitions in quantum paraelectrics.

Y.G. Wang, W. Kleemann, J. Dec, and W.L. Zhong

Computer simulations of defects in ferroelectric perovskite KNbO₃ crystals.

R.I. Eglitis, E.A. Kotomin, A.V. Postnikov, N.E. Christensen, and G. Borstel

External dynamic model for stretched exponential relaxation.

W.Q. Cao, and A.X. Kuang

Dielectric property study of ferroelectric strained superlattice.

J. Zhang, Z. Yin, and M.S. Zhang

Phase transition and dielectric properties of La-doped Pb(Zr,Sn,Ti)O₃ ceramics under hydrostatic compression.

Z. Xu, T.Q. Yang, P. Liu, L.Y. Zhang, and X. Yao

Origin of PTC effect of donor-

AMF-2 PAPERS

doped barium titanate.

S.P. Gong, B.Y. Li, and S.L. Jiang

Improper ferroelectric phase transitions in crystals having complex structure of a cell.

V.A. Adamov, B.M. Darinskii, A.A. D'Jachenko, and L.A. Shuvalov

Structure of domain boundaries arising at the phase transitions in pyroelectrics.

B.M. Darinskii, A.P. Lazarev, and A.S. Sigov

GLASS, AMORPHOUS & COMPOSITES

Polarization dynamics in deuteron glass systems.

S.I. Kwun, K.H. Noh, J.G. Yoon, and W. Kleemann

Sol-gel versus nanocomposite processing of electroceramics.

S. Komarneni

Electromagnetic wave absorptive properties of Fe_2O_3 and TiO_2 composite materials.

M. Chino, T. Yamamoto, A. Yamamoto, and M. Kobayashi

Growth mechanism of LiTaO_3 polycrystal at the disordered matrix of $\text{LiTaO}_3\text{-SiO}_2$.

S.J. Kim, J.H. Cho, G.W. Lee, and Y.S. Yang

Transparent $\text{KTiOPO}_4/\text{SiO}_2$ nanocomposite glass for second-order nonlinear optical application.

D.L. Li, L.Y. Zhang, X. Yao, and L.B. Kong

Dielectric and optical properties of the composite thin films of ferroelectric and semiconductor quantum dots.

J. Zhou, Y. Fu, Z.L. Gui, and L.T. Li

GLASS & POLYMERS

Origins of apparent and real ferroelectricity in polymers.

R. Gerhand-Multhaupt, D. Rollik, and M. Wegener

Antiferroelectricity in achiral mesogenic mixtures of organic materials.

E.A. Soto Bustamante, S.V. Yablonskii, R. Werner, L.A. Beresnev, L.M. Blinov, W. Haase, and L. Garay

Polymorphism in the solid phase of FLC MBOPDoOB induced by rapid cooling.

L. He, Z.X. Shen, Z. Yin, M.S. Zhang, W.S. Li, and S.H. Tang

Properties of thin ferroelectric polymer films.

I.L. Guy, A. Limbong, Z.J. Zheng, and T.L. Tansley

Spontaneous polarization in dipolar fluids.

X.L. Lei, F. Ding, H. Wei, and N.B. Ming

Nanocomposite of semiconducting ferroelectric dots in organic modified silicate matrix.

Y.H. Xu, Francisco del Monte, C. Chia, and J.D. Mackenzi

0-3 nanocomposites for pyroelectric applications.

H.L.W. Chan, Q.F. Zhou, Q.Q. Zhang, and C.L. Choy

Thermally stimulated depolarization current of PT/P(VDF-TrFE) 0-3 composites.

X.Y. Zhang, Z. Peng, H.L.W. Chan, and C.L. Choy

Deposition and characterization of Er^{+3} co-doped sol-gel silica films on SOS.

Z. Xiang, Y. Zhou, Y.L. Lam, Y.C. Chan, and C.H. Kam

Dynamic displacement of the longitudinal mode monolithic multilayer piezoelectric actuator.

G.R. Li, D.R. Chen, Q.R. Yin, C. Bi, and W. Guo

DEVICES & MEMS

Ferroelectric thin and thick films for piezoelectric and pyroelectric microdevices.

N. Setter, E.L. Colla, and P. Muralt

Characteristic study of piezoelectric thick film actuators for computer hard disk drive.

Z. Zhang, W. Zhu, and K. Yao

Engineering charts of resonant frequencies of PZT rings at different clamping conditions.

Y. Xu, B. Koc, K. Uchino, and L.L. Chew

Ultrasonic motors driving by single-phase high frequency.

J.S. Kim, M.J. Park, and K. Uchino

Study of large hydrogen polarization potential in MFM capacitive device using amorphous $(\text{Ba,Sr})\text{TiO}_3$ thin films.

W. Zhu, O.K. Tan, J. Deng, and X. Yao

AMF-2 PAPERS

Photostrictive actuators and its physical properties.

M. Ichiki, J. Akedo, Y. Morikawa, K. Ozaki, and Y. Ishikawa

Sensors for ultrasonic wire bonding process control.

S.S. Chiu, H.L.W. Chan, S.W. Or, C.W. Yuen, and P.C.K. Liu

Piezoelectric ultrasonic motor and fine positioner with two freedoms.

S.X. Dong, S.X. Wang, and L.T. Li

Anomalous nonlinear dielectric constant in vinylidene fluoride-trifluoroethylene copolymer.

G.R. Li, S. Hideshige, I. Susumu, and O. Hiroji

A standing wave type ultrasonic motor.

T.S. Zhou, L.Y. Chai, C.X. He, Y.B. He, and A.X. Kuang

The application of ferroelectric materials in micro-electro-mechanic systems (MEMS).

S.B. Zhang, X.Y. Guo, and J.T. Xu

New design longitudinal and torsional vibrator combination-type ultrasonic motor.

M. Aoyagi, and Y. Tomikawa

Sol-gel processing of piezoelectric thin films for MEMS applications.

I.R. Abothu, Y. Ito, S. Komarneni, and K. Uchino

Pb(Zr,Ti)O₃ films fabrication by sol-gel method for piezoelectric actuated device.

B.J. Kim, J.C. Lee, and J.B. Yoo

Effect of tool drop on the performance of a high frequency piezoelectric wire-bonding transducer.

S.W. Or, H.L.W. Chan, K.C. Cheng, Y.M. Cheung, C.W. Yuen, and P.C.K. Liu

A new type of piezoelectric-electrorheological plane stepper motor.

S.X. Dong, S.X. Wang, and L.T. Li

Voltage effect of BaTiO₃-base thin film and miniature bulk PTCR.

S.G. Song, X.R. Fu, M.D. Tao, and G.M. Wu

Pattern recognition of acoustic emission signals from piezoelectric ceramics during the application of DC electric fields for source identification.

A. Dode, and Rao S.P. Mallikarjun

MEASUREMENTS & CHARACTERIZATIONS

Ellipsometric spectra and optical constants of PZT and PLZT thin films.

D. Mo. D. Zhu, Y. Zhang, H. Li, Y. Xu, and J.D. Mackenzie

The raman scattering in relaxor ferroelectrics.

H. Ohwa, M. Iwata, N. Yasuda, and Y. Ishibashi

Measurement and simulation of the transient voltage drop of charged paraelectric and ferroelectric thin film capacitors.

M. Schumacher, M. Deschler, B. Schulte, H. Juergensen, and R. Waser

PH dependence of formation of

stoichiometric precursors for calcium, cadmium, and lead titanates - a thermal study.

Rao A.V. Prasada, and M. Suresh

Surface charge density and evolution of domain structure in triglycine sulfate by EFM.

J.W. Hong, K.H. Noh, S.I. Kwun, and Z.G. Khim

Surface acoustic wave properties of La₃Ga₅SiO₁₄ crystals.

M Adachi, T. Karaki, W. Miyamoto, and K. Yamamoto

Vibration spectroscopy of structural phase transitions in Zr-rich Pb(Zr_{1-x}Ti_x)O₃.

S Kojima, and X.L. Dong

Raman and IR study of phase transition in potassium scandium double tungstate.

M. Maczka, S. Kojima, and J. Hanuza

Study on the interface of piezoelectric ceramic and internal electrode in the monolithic multilayer piezoelectric actuator.

G.R. Li, D.R. Chen, X.Y. Wei, W.C. Zhang, and Q.R. Yin

The non-regular behavior of series resonant circuit: Role of a ferroelectric material.

S.N. Drozhdin, A.Yu Shchekotov, B.I., Ogienko, and O.N. Shapovalova

Microstructural characterization of ferroelectric Pb(Sc_{0.5}Ta_{0.5})O₃ ceramics.

Z.X. Xiong, K.Z. Baba-Kishi, and F.G. Shin

AMF-2 PAPERS

X-ray study of phase transition in the langbeinite-type $K_2Mn_2(SO_4)_3$ crystals.

C. Moriyoshi, and K. Itoh

Characteristic feature of the ferroelectric phase transition in Rochelle salt.

Y. Shiozaki, K. Shimizu, A. Oka, N. Noda, and R. Nozaki

Phase transitions in $LiK_{1-x}(NH_4)_xSO_4$ crystals.

P.T.C. Freire, W. Paraguassu, A.M.R. Teixeira, J.M. Sasaki, I. Guedes, F.E.A. Melo, and J. Filho Mendes

Grain size effect of ferroelectric properties in nano-crystalline perovskite materials.

R.S. Katiyar, and J.F. Meng

Structural change in the paraelectric phase of ammonium Rochelle salt.

K. Shimizu, T. Kikuta, R. Nozaki, and Y. Shiozaki

Powder X-ray diffraction study in Cs_2ZnI_4 .

T. Kurihama, T. Izumi, and F. Shimizu

Studies on the fatigue properties of $SrBi_2Ta_2O_9$ ferroelectric thin films.

Z.G. Zhang, J.S. Liu, Y.N. Wang, J.S. Zhu, F. Yan, X.B. Chen, and H.M. Shen

Factors influence PTCR effect based on Heywang's model.

P.C. Wang, Z. Li, B.M. Xu, and Z.W. Yin

Structure and dielectric behavior of barium cuppro molybdate ceramic.

N.G. Durge, A.J. Ranade, and S.V. Salvi

G-ray irradiation effects of Au/ $PbZr_{0.52}Ti_{0.48}O_3/YBa_2Cu_3O_{7-}$ capacitors which were fabricated on $LaAlO_3$ and YSZ substrates.

J.X. Gao, L.R. Zheng, J.M. Zheng, L.W. Wang, and C.L. Lin

Hydroxyl defects in alpha quartz and their radiation effects.

H. Bahadur

DOMAIN

Open and challenging questions in ferroic domain studies.

J. Fousek

Domain structures, domain wall mobility and ferroelectricity in $PbTiO_3$ and $SrBi_2Ta_2O_9$ thin films.

Y.N. Wang

Pulse response measurement of transient phenomena on ferroelectric domains in PZT ceramics.

T. Ogawa, and K. Nakamura

Fatigue properties and microstructural evolution of $(Pb_{1-x}Sr_x)TiO_3$ ceramics.

C.S. Hou, and C.C. Chou

Domain structures of $PbTiO_3$ single crystals by AFM and KFM.

T. Yamamoto, T. Ida, and S. Omika

AFM observation of domains of WO_3 .

S. Hamazaki, N. Tashiro, F. Shimizu, S. Sawada, and M. Takashige

AFM observations on surface topography of TGSP cleavage surface and effect of humidity on

the surface structure.

S. Balakumar, and J.B. Xu

Microstructural characteristics of $(Pb_{0.6}Sr_{0.4})TiO_3$ ceramics prepared by microwave sintering.

C.C. Chou, C.S. Hou, and I.N. Lin

Kinetics of formation of domain structure in ferroelectric and ferroelastic films under cooling with a finite rate.

B.M. Darinskii, A.P. Lazarev, A.S. Sigov, and L.A. Shuvalov

Domain structure in the plate at non-inherent phase transition of the second kind.

B.M. Darinskii, A.P. Lazarev, and A.S. Sigov

Electron acoustic imaging of ferroelectric domains and its mechanism.

Z.R. Yin, J. Liao, and Y. Yang

Observation of domain movement on $BaTiO_3$ crystal under applied electric field using scanning electron acoustic microscopy (SAM).

J. Liao, Y. Yang, S.X. Hui, H.S. Luo, and Q.R. Yin.

Domain structures and polarization arrangements in $PbTiO_3$ single crystals.

C.C. Chou, and P.H. Chen

AFM studies on domain structure in TGSP single crystals: Evidence for the movement of the domain wall towards the negative domain.

S. Balakumar, J.B. Xu, G. Arunmozhi, and N. Nakatani

Ferroelectric domain structure

AMF-2 PAPERS

studies on PbTiO_3 single crystals by polarizing microscope, SEM and AFM.

S. Moorthy Ganesa, S. Balakumar, C. Subramanian, and P. Ramasamy

Frequency dependence of coercive field and domain walls mobility in deuterated triglycine sulphate crystals.

L.N. Kamysheva, and T.N. Podgornaya

The observation of domain structure in ferroelectric K_2TeO_3 .

K. Matsuki

Structure and interaction of the domain boundaries in ferroics with defects of crystal lattice.

B.M. Darinskii, and V.V. Shalimov

Phase transitions in $\text{RbLi/WO}_4/\text{RbLiMoO}_4$ ceramics.

S.N. Choudhary, and K. Prasad

Domain structure studies on L-crystine doped tri-glycine sulphate crystals using scanning electron microscope.

K. Meera, G. Arunmozhi, and P. Ramasamy

OPTICS & NONLINEAR PROPERTIES

Theory of far infrared optics of ferroelectrics.

D.R. Tilley

Czochralski growth and optical properties of undoped and co-doped strontium barium niobate crystals.

M.H. Li, X.W. Xu, T.C. Chong, H. Kumagai, and M. Hirano

Electrooptic effects in PVDF/PMDF blends: Poling and relaxation process.

J.S. Lim, K.T. Yu, E. Lim, and G.S. Park

Electrooptic coefficients of proton-exchanged LiNbO_3 waveguides.

H.X. Zhang, C.H. Kam, Y. Zhou, Y.L. Lam, Y.C. Chan, L.S. Qiang, C.Q. Xu, and Z.G. Ma

Phonon properties and phase transitions in lead titanate, barium titanate, and the doped systems.

M.S. Zhang, and Z. Yin

Nonlinear optics of ferroelectrics.

J. Osman, Y. Ishibashi, and D.R. Tilley

Photorefractive properties of (Cu,Ce)-doped

$(\text{K,Na})_{0.1}(\text{Sr}_{0.6}\text{Ba}_{0.4/0.9})\text{Nb}_2\text{O}_6$ crystal.
Y.L. Zhang, M. Dang, E.Y.B. Pun, and P.S. Chung

Sol-gel preparation and optical nonlinearity of CdS microcrystal-lite-doped $\text{SiO}_2\text{-TiO}_2$ thin films.

J.W. Zhai, W.S. Shi, L.Y. Zhang, and X. Yao

Zero-phonon optical lines of impurity centres in ABO_3 perovskite-like ferroelectrics.

V. Trepakov, V. Vikhin, S. Kapphan, and L. Jastrabik

Linear and nonlinear optics of ferroelectric films and particles.

R.L. Stamps, and D.R. Tilley

Raman spectroscopy of $\text{SrBi}_2\text{Ta}_2\text{O}_9$ and related ferroelectrics.

S. Kojima, and I. Saitoh

Growth and properties of potassium lithium niobate single crystals.

L. Li, T.C. Chong, Q.Z. Jiang, X.W. Xu, H. Kumagai, and M. Hirano

Second harmonic generation in transparent $\text{KTiOPO}_4/\text{SiO}_2$ nano-composite glass prepared by the sol-gel method.

D.L. Li, L.Y. Zhang, X. Yao, and L.B. Kong

Structural and optical waveguide of sol-gel deposited ferroelectric PZT (50/50) thin films.

J.W. Zhai, T. Yang, H.Q. Yang, L.Y. Zhang, and X. Yao

Optical transmission through ferroelectric thin films as a probe of surface terms.

S. Alwi, and J. Osman

Birefringence and second harmonic generation in PVDF/PMMA blends.

E. Lim, J.S. Lim, J.W. Moon, K.T. Yu, and G.S. Park

Blue light emission from nanometer-sized strontium titanate.

W.F. Zhang, M.S. Zhang, G.H. Ma, and Z.L. Du

Optical scattering in Fe:LiNbO_3 planar waveguides.

H.X. Zhang, Y. Zhou, C.H. Kam, Y.L. Lam, J.D. Xu, and S.T. Liu

Real-time pseudoscopic image reconstruction by a conjugate wave in a ferroelectric crystal.

J. Puttappa

Characterization of second-harmonic generation in Thus-Morse

AMF-2 PAPERS

AMF-2 SUMMARY REPORT

Abstracts received	345
Presentations scheduled	309
Invited talks	43
Manuscripts	189
Tutorial participants & lecturers	37 & 3
Delegates	203
Countries and regions	22
Sponsors/exhibitors/advertisers	16

optical lattice.

X.J. Liu, Z.L. Wang, and N.B. Ming

The cascaded nonlinearity for optical bistable effect in periodically poled LiNbO₃.

Y.Q. Qin, Y.Y. Zhu, S.N. Zhu, and N.B. Ming

Photo-induced light scattering in Co-,Cr- and Fe-doped lithium biobate.

K. Chen, and M.S. Zhang

Optical absorption properties of nanocrystal bismuth titanate thin films.

H.S. Gu, D.H. Bao, and X.J. Li

Studies on optical propagation loss of silica/titania nanocomposite films.

M.Q. Wang, T. Yang, L.Y. Zhang, and X. Yao

EPR and optical absorption studies of SrCu(HCOO)₄ single crystals.

N. Narsimlu, K. Kumar Siva, and G. Sastry Sivarama

Growth and characterization of phosphate mixed ZTS crystals.

P.M. Usharee, R. Jayavel, and P. Ramasamy

Microstructure properties of nano-sized PbTiO₃ powders derived from high energy ball millin.

L.B. Kong, W.G. Zhu, and O.K. Tan

Ferroelectricity Newsletter

including all back issues is available on Internet

<http://www.sp.nps.navy.mil/projects/ferro/ferro.html>

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ANNIVERSARY

30TH ANNIVERSARY OF THE FERROELECTRIC PHYSICS DEPARTMENT IN RIGA

The Ferroelectric Physics Department of the Institute of Solid State Physics of the University of Latvia celebrated 30 years of existence on 1 October 1998.

Investigation of ferroelectric phenomena at the University of Latvia began with Professor Voldemar Fritsberg. His research activities on ferroelectric solid solutions started as early as 1956 during his graduate studies at the Department of Physics and Mathematics. The first paper concerning ceramic ferroelectric lead-strontium-bismuth titanate and lead-calcium-bismuth titanate solid solution series was published in 1957 in the *Bulletin of the Latvian Academy of Sciences*. Characteristics of diffused ferroelectric phase transitions in these materials were the first results of ferroelectric studies presented by the University of Latvia at the First International Meeting on Ferroelectricity (IMF-1) in Prague in 1966.

Since 1963 an expanding group of physicists and chemists at the University were engaged in comprehensive studies of ceramic ferroelectric materials – from sintering to the theory of ferroelectric phenomena. In 1968 the Laboratory of Ferroelectricity was established, and the 6th Soviet Meeting on Ferroelectricity was held at the University of Latvia in Riga. The presence of representatives from Czechoslovakia, Germany, and Poland appeared fruitful for further international cooperation in the activities of ferroelectric research in the newly organized laboratory.

Since the end of the 1960s, highly nonlinear (PMN, PSN, PZN and their multicomponent solid solution systems) and transparent ferroelectric ceramic materials (PLZT-, PSN-based compositions) have been studied. In addition, studies of compositions with pronounced electrostrictive properties were initiated in 1970s when the Laboratory of Ferroelectricity became a department of the Institute of Solid State Physics. Attention is paid as well to ordering effects in $AB_2B'O_3$ perovskites and design of effective electrocaloric materials (originally modified PST-based solid solutions synthesized).

Professor V. Fritsberg died in 1982 at the age of 56. The 15 years after his death have shown that the

school of ferroelectric studies he created has survived and continues the efforts of its founder. The number of employees has been growing steadily until it reached its maximum of 50 in 1989.

The Ferroelectric Physics Department organized four meetings on Transparent Ferroelectric Ceramics, including the international conference TFC'91 in October of that year, and participated in organizing the international conferences on Electronic Ceramics in 1990 and Advanced Optical Materials and Devices in 1996.

Since 1991, when Latvia regained its independence, despite the loss of more than half of the staff because of unfavorable economic conditions, research activities in the Ferroelectric Physics Department have continued and remained faithful to its policies of covering the problems of production, properties, and application.

Besides chemical coprecipitation and hot pressing technologies, the pulsed laser deposition and sol-gel techniques for ferroelectric thin film processing are being developed. Problems of phase transitions in relaxors and normal ferroelectrics, new relaxor material systems, ordering effects in polar dielectrics and ferroelectric thin film heterostructures are being studied with respect to various possible applications of "smart" ferroelectric materials in electronics, optoelectronics, and microelectromechanics.

International cooperation is developed and strengthened. Presently the Ferroelectric Physics Department cooperates with research centers in Austria, the Czech Republic, Denmark, Finland, France, Germany, Japan, Norway, Russia, Slovenia, Spain, Sweden, USA, and other countries, participates in COST 514 European Union Concerted Action in Ferroelectric Thin Films, and has presented reports at regular international meetings on ferroelectricity and applications of ferroelectric materials.

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 e-mail: stern@latnet.lv

PUBLICATIONS

A comprehensive treatise by the experts in the field...

ELECTRETS NOW AVAILABLE IN ITS THIRD EDITION

The field of electrets has developed rapidly with an increasing number of new materials, methods for investigating charge-storage phenomena, and the development of creative and exciting applications. This third edition of *Electrets*, printed in two volumes, documents the significant contributions to the knowledge and understanding of this field.

Although there have been monographs and proceedings of conferences published on this topic, there has been no cohesive treatment of the entire field of electrets until the original publication of Dr. Sessler's seminal work, *Electrets*, first edition. Now he and his colleagues, plus younger scientists who bring a fresh perspective to this field, continue to contribute and update the series by offering this latest comprehensive survey of noteworthy developments in the field of electrets.

VOLUME 1

Gerhard M. Sessler, Editor

Technical University of Darmstadt, Germany

Reprint of the 1987 second edition with updates and corrections. This volume covers all the basics plus the important research from 1929 to 1987.

Contents

Physical principles of electrets - Sessler
 Thermally stimulated discharge of electrets - van Turnhout
 Radiation-induced charge storage and polarization effects - Gross
 Piezo- and pyroelectric properties - Broadhurst, Davis
 Bioelectrets: Electrets in biomaterials and biopolymers - Mascarenhas
 Applications - Sessler, West
 Recent progress in electret research from the 1979 first edition - Gerhard-Mulhaupt, Gross, Sessler

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VOLUME 2

Reimund Gerhard-Mulhaupt, Editor

University of Potsdam, Germany

Five chapters on the hot topics in electrets providing a digest of the significant progress in electret research over the 11 years since the 1987 publication of the second edition. This compendium is based on special issues of the *IEEE Transactions*, with further extensive updates by each contributor.

Contents

Space-charge electrets - Kressman, Sessler, Gunther
 Piezoelectric polymer electrets - Eberle, Schmidt, Eisenmenger
 Pyroelectric polymer electrets - Bauer, Lang
 Nonlinear optical polymer electrets: Current practice - Bauer-Gorgonea, Gerhard-Mulhaupt
 Inorganic ceramic/polymer ferroelectric composite electrets - Dias, Das-Gupta

ISBN 1-885540-09-4

Also of interest...

Contact and Frictional Electrification
by W.R. Harper

How two solids can become charged by being rubbed together has puzzled natural philosophers for more than 2,000 years; a convincing explanation in terms of what charge carriers move and why they move has proved remarkably elusive. Dr. Harper shows that the circumstances in which electrification appears provide the clues which enable the phenomena to be brought into line with solid-state theory, though the account is not yet fully coherent. Metals and semiconductors are seen to behave quite differently from insulators which themselves are of two kinds, the one reluctant to charge but extremely retentive of any charge it may possess, the other charging freely.

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PUBLICATIONS

*Under the lupe...***CONDENSED MATTER NEWS ADOPTS NEW EDITORIAL PHILOSOPHY**

In Volume 6, Issues 3-4, 1998, Patrick Bernier, Editor of *Condensed Matter News*, states: "This is the first issue of *Condensed Matter News* with its new editorial board (yet to be completed) and under a new editorial philosophy.

We are fortunate to have the opportunity to publish the papers contained in this issue, which concern the fascinating world between the macro- and the nanoscale systems. My wish is that such proceedings attract more and more young scientists from chemistry, physics, biology, materials science, and engineering – experimentalists and theoreticians – toward this domain where the number of atoms is 'not so large,' the classical principles no longer apply and we can count the number of electrons on our finger! It can be considered as the ultimate step toward the miniaturization (to the nanoscale) of solid state devices."

Judging from the composition of the editorial board – Darrell Comins, University of Wits, South Africa; Denis Fichou, CNRS, France; Roberto Lazzaroni, University of Mons, Belgium; John Reynolds, University of Florida, USA; Siegmur Roth, MPI, Stuttgart, Germany; Juliusz Sworakowski, University of Wroclaw, Poland; and Katsumi Tanigaki, NEC, Japan – contributions come from all parts of the globe.

The aforementioned **Volume 6, Issues 3-4, 1998** contained the following articles, called "Overviews":

Space-resolved manipulation of DNA

M. Washizu, T. Yamamoto, O Kurosawa, N. Shimamoto

Near-field optical microscopy: Fifteen years of existence

D. Courjon, M. Spajer, F. Baida, C. Bainier, S. Davy

High resolution X-ray lithography and electron-beam lithography: Limits and perspectives

Y. Chen, C. Vieu, H. Launois

Silicon bulk micromachining and nanomachining

M. Eashi, K. Minami, T. Ono

Some aspects of nanotechnologies and their possible connections with microsystems

M. Lannoo

Carbon single wall nanotubes: Elaboration and physical properties

P. Bernier, C. Journet, W.K. Maser, A Loiseau, M. Lamy de la Chapelle, S. Lefrant, P. Deniard, R. Lee, J.E. Fischer

Construction of microscopic and macroscopic assemblies from supramolecular systems: Research at the chemistry-biology interface

A.W. Coleman, M. Munoz, P. Goreloff, R. Lamartine, F. Lequvre, J. Mugnier

Micro-nanotechnology for artificially designed network construction of protein molecules and living cells

M. Aizawa

Volume 7, Issue 1, 1998 features the following articles:**Hydrogenated amorphous carbon: A complex and versatile form of disordered carbon**

Marie-Luce Theye, Valérie Paret, Abdelouahed Sadki

Spin orientations in ultrathin magnetic films with normal surface anisotropy

Xiao Hu

Intermetallic-nonmetallic intergrowth structures: A useful approach to new materials

Arnold M. Guloy, Joanna Goodey

In addition to articles, *Condensed Matter News* brings meeting reports, information on new products, books reviews, and a calendar.

To find out more about this publication, visit their website: http://www.gbhap.com/Condensed_Matter_News/

PUBLICATIONS

An international journal on sensor technology...

SENSORS AND MATERIALS

This journal is designed to provide a forum for people working in the multidisciplinary fields of sensing technology. *Sensors and Materials* publishes contributions describing original work in the experimental and theoretical fields, aimed at the understanding of sensing technology, related materials, associated phenomena, and applied systems. Expository or review papers and short notes are also acceptable.

Volume 10, Number 7, 1998, contains the following five papers given at the first CAD for MEMS workshop, held in Zürich, Switzerland, in March 1997:

The sensor cube revisited
Simon Middelhoek

Applications of harmonic finite element analysis to a CMOS heat-capacity measurement structure
Markus Emmenegger, Jan G. Korvink, Martin Bächtold, Martin von Arx, Oliver Paul, Henry Baltes

Dynamic modeling of a tunable microgyroscope
Myung-Seok Kang, Sung-Kie Youn, Young-Ho Cho, Ki Bang Lee

CAD for silicon anisotropic etching: Effect of etching products and diffusion
Osama Tabata

Circuit modeling and SPICE simulation of mixed-signal microsystems
Hoan H. Pham, Arokia Nathan

In memoriam ...

ALONA S. MILLER, ISIF COORDINATOR SINCE ITS INCEPTION

A year ago, at the 10th International Symposium on Integrated Ferroelectrics in Monterey, the anniversary brochure had a short piece called "Linking a multilayered unit."

It was written with a twofold purpose in mind: One was to emphasize the importance of linking whenever we deal with a complex entity, be it in science or human relations. The other was to honor Alona, who has served as such a personal link within the ferroelectrics community and who, for the first time in the history of ISIF, was absent from an event due to illness.

On 2 October of last year, Alona died peacefully in her home in Colorado Springs. She had accepted her terminal illness the way she lived her life: fully facing her situation, weighing her options, making a decision, and carrying it out so that she, surrounded by the love and care of her family, and the people close to her would get the greatest benefit from the time she would remain with us here on earth.

A year later, when many of us gather in Colorado Springs for the 11th International Symposium on Integrated Ferroelectrics, we would like to repeat what was said a year ago about Alona S. Miller.

Every community likes to think of itself as a coherent unit. The international community of ferroelectrics experts is no exception. And every community needs a cohesive element. Even though many women and men have enthusiastically contributed their talents and skills to fuse different personalities into a more or less smoothly working entity, nobody has given more time, dedication and know-how to the cooperative functioning of this global group of scientist and engineers than Alona S. Miller. As ISIF coordinator she has steered the annual gatherings from their inception in 1989 through calm seas and stormy weather, keeping a firm hand on the helm. From her office at the University of Colorado at Colorado Springs she made sure that the lines of communication stayed open, gathering information and disseminating it again in useful form all over the world.

Due to health reasons, this year Alona stayed at the sidelines of daily activities, accompanying the preparations of the 10th anniversary of ISIF with her advice coming from years of experience.

We miss her a lot, her cheerful voice, her friendly smile, her competent help. And we thank her for a decade of dedicated work to help make ISIF the success it is today.

UPCOMING MEETINGS

**Ferroelectrics Workshop in Puerto Rico (FWPR'99)
13-14 May 1999
Guánica, Puerto Rico**

A ferroelectric workshop will be held at the Hotel Copamarina Beach Resort in Guánica, Puerto Rico, 13-14 May 1999. The purpose of this workshop is to provide a forum for an exchange of scientific ideas and technological advances in the areas of processing and applications of ferroelectric materials. Participation in the workshop is expected to be of approximately 70 participants from the continental United States and Puerto Rico, plus about 20 local students. This makes it large enough for two full days of presentations, but still small enough to promote effective networking and interactions among attendees. A goal of the conference is to encourage informal interactions among the participants.

Topics

The conference is open to scientists, engineers, and students working in the field of ferroelectric materials and their applications. The presentations will be arranged in single sessions, while allowing for reasonable amounts of time for discussion of each paper. The conference program will consist of oral presentations with particular emphasis on the following topics:

- Materials processing and integration
- Process and substrates
- Fundamental properties
- Thin films: Growth and characterization
- Materials characterization
- Tunable microwave devices: Design, fabrication, and testing
- Conductor/ferroelectric interfaces
- Hybrid structures and devices: GaAs/ferroelectric; Si/ferroelectric memories
- Ferroelectric/ferrite components

Speakers

Some of the speakers for the workshop are:

G. Subramanyam, Univ. of Dayton; J. Horwitz, NRL; F. Van Keuls, NASA; H. Jiang, NZAT; J. Levy, Univ. Pittsburgh; D. Chrisey, NRL; C. Chen, Univ. Houston; R. Ramesh, Univ. Maryland; K. Harshavardan, Neocera; C. Rogers, Univ. Colorado; O. Auciello, Argonne; X. Xi, Penn State; S. Streiffer, Argonne; L. Sengupta, Paratek; A. Bhalla, Penn State; X. Xiang, LBNL; S. Talisa, Northrop Grumman.

Abstracts

Deadline: 26 February 1999

Mail abstracts to; Dr. Félix A. Miranda, NASA Administrator's Fellow, University of Puerto Rico at Humacao CUH Station, Physics, Humacao, P.R. 0079; phone: +787- 850-9381 ext. 9010; fax. +787-850-9308; e-mail: fa_miranda@cuhac.upr.clu.edu

Contact

Ms. Evelyn Rivera, Project Manager, EPSCoR, University of Puerto Rico, P.O. Box 23334 University Station, San Juan, Puerto Rico 00931-3334; e-mail: evelyn@adam.uprr.pr

UPCOMING MEETINGS**7th International Conference on Ferroelectric Liquid Crystals (FLC99)
29 August - 3 September 1999****Darmstadt University of Technology, Germany**

The conference is the 7th in a series of biennial international meetings. The first conference was held in Arcachon, France, (1987), followed by Gothenburg, Sweden, (1989), Boulder, USA, (1991), Tokyo, Japan, (1993), Cambridge, UK, (1995), and Brest, France, (1997). The main goal is to bring together scientists, engineers, and students active in the field of ferroelectric liquid crystals and related topics to present and discuss their recent and advanced developments in this area. The program will consist of invited lectures, oral, and poster contributions. Tutorials, demonstrations, and exhibitions will be a part of the conference. The proceedings will be published in special volumes of *Ferroelectrics*.

Topics

- Synthesis and design of new materials
- Properties of new mixtures for application
- Banana-shaped and achiral switchable systems
- Ferroelectric, ferrielectric, antiferroelectric, and TGB phases
- PSFLCs, PDFLCs, and FLC networks
- Ferroelectric and pyroelectric polymers: Ferroelectric and chiral biopolymers
- Surface interfaces
- Modeling of FLCs
- Linear, nonlinear, and electrooptical properties
- Device technology, addressing, switching, alignment
- Nondisplay applications, light modulation, data processing, telecommunication
- Display applications

Abstracts

Deadline: 31 March 1999

Contact

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**European Conference on Macromolecular Physics (EPS'99)
30 September - 2 October 1999
University of Potsdam, Germany**

The topics of the conference will be molecular orientation in polymers, their generation, characterization, and application.

Contact

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CALENDAR OF EVENTS 1999

Mar 7-10	• 11th International Symposium on Integrated Ferroelectrics (ISIF '99), Colorado Springs, Colorado, USA (see <i>Ferroelectricity Newsletter</i> , Vol. 6, No. 3, p. 16)
May 13-14	• Ferroelectrics Workshop in Puerto Rico (FWPR'99, Guánica, Puerto Rico, (see p. 22)
May 26-29	• 16th Meeting on Ferroelectric Materials and Their Applications (FMA 16), Kyoto, Japan (see <i>Ferroelectricity Newsletter</i> , Vol. 6, Nr. 4, p. 35)
Jun 7-10	• Transducers '99: The 10th International Conference on Solid-State Sensors and Actuators, Sendai, Japan (see <i>Ferroelectricity Newsletter</i> , Vol. 6, No. 3, p.17)
Jun 24-26	• 3rd Korea-Japan Conference on Ferroelectrics, Kyungju, Korea (see <i>Ferroelectricity Newsletter</i> , Vol. 6, Nr. 4, p. 35)
Jul 12-16	• 9th European Meeting on Ferroelectricity (EMF-9), Prague, Czech Republic (see <i>Ferroelectricity Newsletter</i> , Vol. 6, No. 3, p. 18)
Aug 29- Sep 3	• 7th International Conference on Ferroelectric Liquid Crystals (FLC 99), Darmstadt, Germany (see p. 23)
Jul 31- Aug 1	• Short Course on Crystal Growth, Tucson, Arisona, USA (see <i>Ferroelectricity Newsletter</i> , Vol. 6, No. 3, p. 19)
Aug 1-6	• 11th American Conference on Crystal Growth and Epitaxy, Tucson, Arizona, USA (see <i>Ferroelectricity Newsletter</i> , Vol. 6, No. 3, p. 19)
Aug 4-13	• 18th International Union of Crystallography and General Assembly, Glasgow, Scotland Gill Houston, crystal@glasconf.demon.co.uk or Chris Gilmore iucr99@chem.gla.ac.uk
Sep 30- Oct 2	• European Conference on Macromolecular Physics (EPS'99), Potsdam, Germany (see p. 23)