
Ferroelectricity Newsletter

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

Volume 5, Number 1

Winter 1997

ASSESSMENT OF THE PAST, PREVIEW OF THE SUMMER

We begin the fifth year of publishing this newsletter with the concluding installment of **Professor Eric Cross's** account of the history of ferroelectricity. Having called the previous section "The Golden Years," he remarks that it would have been delightful to head this last chapter "The Diamond Years." But he goes on to say, "Unfortunately, as well as being open to misinterpretation, it would have glossed over changes in science and technology at universities, in government, and in industry which have certainly made all our lives significantly more difficult and less productive and give real cause for some serious comment from the 'older dogs' in the business." Thank you, Professor Cross, for telling the story of ferroelectricity from the vantage point of your rich experience in the field combined with the strong engagement of your heart.

The Fall 1996 issue listed Part I of the papers given at the **3rd European Conference on Applications of Polar Dielectrics**, held 26-29 August 1996 in Bled, Slovenia. This issue brings you the second and concluding part of the presentations. In addition, you will find Part I of the papers delivered at **ISAF '96**, which took place 18-21 August 1996 at East Brunswick, New Jersey.

We thank the chairman of ISAF '96, **Professor Amid Safari**, whom Prof. Cross called "an organizing genius," for his report on the meeting. At the same time we welcome **Professor Xia Zhongfu**, chairman of the **9th International Symposium on Electrets (ISE 9)**, to the ranks of our contributors and express our appreciation for his report.

This summer has "a first" in store when it comes to conferences. Three international meetings, **ISAF XI**, **ECAPD IV**, and **Electroceramics VI**, will take place simultaneously at the same location. And what a location it is! From 24 to 27 August 1997*, scientists and engineers will convene at the Congress Centre Montreux, Switzerland. Here is the description from the first circular: "Surrounded by mountains, Montreux benefits from a Mediterranean-like microclimate. With palms and other exotic trees lining its shores, Montreux is known as the 'Pearl of the Swiss Riviera.'" Can you imagine an environment more conducive to bringing out the best presentation and discussion of state-of-the-art developments?

See you in Montreux!

* - Correction: These three conferences will take place in **1998**, not 1997. Sorry for the confusion.

-- Rudolf Panholzer
Editor-in-Chief

IN THIS ISSUE

From the Editor	1
History	
Ferroelectricity: The Final Chapter	2
Papers	
ECAPD-3, Part II	2
ISAF '96, Part I	12
Conference Reports	
ISAF '96	12
ISE 9	14
Upcoming Meetings	
ISFP-7	17
ISAF XI, ECAPD IV, and Electroceramics VI	18
EMIF-2	19
Calendar of Events	20

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ECAPD-3 PAPERS, Part II

The following is Part II of the titles and authors of presentations given at the 3rd European Conference on Applications of Polar Dielectrics (ECAPD-3), held 26-29 August 1996 in Bled, Slovenia. Part I was published in the Fall 1996 issue.

Characterization of polarized ferroelectric PZT films by SEM and surface potential measurements

H. Hülz, W. Hässler, and J. Edelmann

New bismuth layer-structured ferroelectrics with niobium ions as B-site

T. Tadashi and S. Takeshi

Dielectric, elastic, and piezoelectric constants of porous PZT ceramics and PMN-pyrochlore mixture

B. Hisao

Hot-forging of $Ba_{6-3x}RE_{8+2x}Ti_{18}O_{54}$ ceramics (RE=La, Ce, Nd,Sm)

C. Hoffmann and R. Waser

Dielectric properties of microwave ceramics deduced from infrared and submillimeter spectroscopy

J. Petzelt, S. Kamba, G.V. Kozlov, and A.A. Volkov

Ferroelectric memories

A.I. Kingon

Ferroelectric thin films for microsensors and microactuators

N. Setter

Growth of new electrooptic crystal DCNP

Fang Chang Shui, Fang Li, Zhuo Hong Sheng, and J.N. Sherwood

-- continued on page 3

HISTORY**FERROELECTRICITY: The Final Chapter**

L. Eric Cross

Evan Pugh Professor of Electrical Engineering
Materials Research Laboratory
The Pennsylvania State University
University Park, PA 16802-4800

For the courageous souls who have been following this set of rather personal reminiscences about a very long career spent almost entirely in ferroelectrics, you will realize with the elapsed time from the last episode that this final chapter has proven much more difficult to write. Firstly there are the major sins of omission from the earlier chapters which need to be rectified, secondly, as one comes close to the present day, the raw edges of events have not been smoothed and mellowed by the passage of time, and there is real danger in making fun, which may quite unintentionally hurt barely healed susceptibilities. Finally, it would have been delightful but I believe untruthful to have been able to head this final episode "The Diamond Years." Unfortunately, as well as being open to misinterpretation, it would have glossed over changes in science and technology at universities, in government, and in industry which have certainly made all our lives significantly more difficult and less productive and give real cause for some serious comment from the "older dogs" in the business.

Firstly, to rectify a very important omission from "The Golden Years." In 1982, before going to China for the first of many trips, I had through the good offices of Arthur Diness and ONR the privilege of plotting with Dr. Kioshi Okazaki at the Japan Defence Academy in Yokosuka a new idea for a US:Japan Meeting on Dielectric and Piezoelectric Ceramics with the objective of bringing together both academic and industrial scientists from these areas to build confidence and be able to exchange information for the mutual benefit of both groups. Okazaki put together the first meeting which was to take place in Rappongi, the center of the entertainment district in Japan. I believe the meeting itself was a real success, and much was done in building friendships after hours by the singing co-chairman, and the horizontal co-chairman (it was a very well-lubricated meeting). My most vivid memory was however of the "thank you" party we were able to hold after the event at the old US Sano Hotel in downtown Tokyo. Kioshi had, in an unlikely moment of weakness, let me into his confidence that rather to his chagrin his #1 daughter was a flamenco dancer. Somehow, however, we managed to bear down on him to invite her to give a dance demonstration for us all at the Sano Party. She was so good, and the audience, both US and Japanese, so thrilled that it was a delight to see father's chest swell with pride. Much later I was delighted to see #1 daughter and her whole class dance for Okazaki at his retirement party in Waseda University.

After the meeting, our Japanese friends, orchestrated by Kioshi, arranged

-- continued on page 3

HISTORY

FERROELECTRICITY: The Final Chapter -- continued from page 2
individual week long tours of Japan's electronic industry for all US participants. Rapongi was so successful it inaugurated a biannual sequence which is continuing to this day.

On returning from China in 1983 Lucilla and I went straight down to Washington for ISAF 5. This was an exceptionally well-organized meeting with Bob Pohanka of ONR in the Chair and Bill Lawless as Program Chair. Bill is a stickler for getting things right and he prowled the corridors of the then Bureau of Standards making sure that all sessions had full rosters of speakers and ran precisely to time. Unfortunately disaster struck on the final day, dear Charley Pulvari who was chairing the first afternoon session dined well, but perhaps not wisely and went fast asleep after introducing the first speaker. This gentleman from Europe in the middle had thirty minutes, but after fifty minutes was still going strong. Fortunately Charley woke up before Bill had apoplexy and all ended well if rather late.

The year 1984 saw the first follow-up US:Japan Meeting at colonial Williamsburg. I was in the Chair and thought we had a first class affair—unfortunately it was marred by the fact that Okazaki's father who had been a top general in the Japan Army was taken terminally ill and Kioshi had to leave before the end and hurry back home. My chest swelled with pride for the meeting, however, as paeans of praise came in from Japan. Fortunately before I got too unbearable, Dr. Wakino let the cat out of the bag on one of his visits to State College, "Eric, the choice of Williamsburg was outstanding, those golf courses were absolutely superb and so cheap!" The meeting did introduce very good poster presentations which have become a highly successful feature of the US:Japan events.

The banner event in 1985 was the IMF 6 Meeting in Kobe using the facilities on Kobe's part island. A truly spectacular high technology venue for the meeting. I came to Kobe ahead of my wife and daughter as I had been earlier in China, and they were both lucky to have caught the United flight just ahead of the JEOL 747 which had such a disastrous crash. Fortunately none of the meeting participants were involved and we all did not know of the terrible tragedy until calls from abroad began to come through thick and fast. Kobe saw the first introduction by Jim Scott and Carlos Araujo of hysteretic ferroelectric thin films, and I think none of us at the time realized that this was the tip of such a substantial and important new iceberg. Directly following Kobe we went on with Dr. Sei-Joo Jang, an MRL faculty member, to spend a week visiting in Korea: Seoul, Tegu, and Pusan with stops in Keist, Sagong University, and the University of Pusan.

A memorable episode was the visit with General Park, Chairman of Pohang Iron and Steel Company. He was interested in ceramics and already was

-- continued on page 4

ECAPD-3 PAPERS, Part II

continued from page 2

Influence of intrinsic and extrinsic defects on the electrooptic properties of lithium niobate

K. Chah, M. Aillerie, M.D. Fontana, and G. Malovichko

Light induced charge transfer properties of intrinsic and extrinsic defects in BaTiO₃

O.F. Schirmer, H. Kröse, A. Mazur, and R. Scharfschwerdt

Selective properties of holograms at nonstationary two-wave processes of amplification in photorefractive polymers

E.S. Kovalenko and S.N. Sharangovich

Analysis of 180° domain structure in barium titanate using nonlinear optics

R.S. Cudney, V. Garcés Chávez, and P. Negrete-Regagnon

Photorefractive optical memories

L. Hesselink

Electrooptic PLZT ceramics in infrared: Properties and applications

M. Ozolinsh

Pyroelectric thin film sensor arrays integrated on silicon

B. Willing, M. Kohli, A. Seifert, K. Brooks, P. Mural, and N. Setter

Landau-de Gennes Theory of the chevron structure

N. Vaupotic, S. Kralj, M. Copic, S. Zumer, and T.J. Sluckin

Efficient blue light second-harmonic generation using ion-implanted KNbO₃ channel waveguides

-- continued on page 4

ECAPD-3 PAPERS, Part II

continued from page 3

T. Pliska, D. Fluck, and P. Günter

Development in single crystal growth of LiNbO₃ using double crucible CZ method

Kitamura Kenji, Furukawa Yasunori, and Iyi Nobuo

Ultrathin ferroelectric polymer films

A. Bune, S. Ducharme, V. Fridkin, L. Blinov, S. Palto, N. Petukhova, and S. Yudin

Control of compositional order-disorder effects in perovskites

A.A. Bokov

New results on layer-structure perovskite ferroelectric thin film memories

J.F. Scott and C.A. Paz de Araujo

Hydrogen induced relaxations in disordered dielectrics

H. Kliem

Integrated ferroelectric thin films for pyroelectric and piezoelectric application

W. Wersing and R. Bruchhaus

Development and current status of high-end pyroelectric devices and systems

Z. Sitar

Quartzhomeotypic gallium-orthophosphate: A new high-tech piezoelectric crystal

P.W. Krempf

POSTER SESSION**Characterization of Materials**

Ferroelectric properties of pure and

-- continued on page 5

HISTORY**FERROELECTRICITY: The Final Chapter --** continued from page 3

envisioning the need to move the company up the technology gradient as the integrated steel mills under construction in China came on stream, and the then vast needs of Korea's booming construction and ship building industries began to diminish. Equally impressive was his diminutive English secretary. Park had no English himself, and would speak for two to three minutes without pause, then she would come in and translate. Sei-Joo was astonished to find that even over such long periods, she was just word perfect. All that competence in such a neat small package!

But what was happening back in the MRL labs in Penn State whilst the faculty were "hot footing" it to these glamorous meetings places. At that time (1982-86) the group had very adequate support from both ONR and NSF in pure and applied topics. Interest was strong on electrostriction in both relaxor ferroelectric perovskites, tungsten bronze crystals, and low permittivity fluorite structure crystals. Dr. Meng¹ constructed the first effective uniaxial compressometer to measure the converse electrostrictive Q_{ijhl} s in BaF₂, SrF₂, and CaF₂. We began the construction of the laser interferometer based ultra-dilatometer for direct measurements, though these were not carried out until much later.² The instrument did however pay off handsomely in permitting us to make the first reliable measurements of d_{33} in PZT thin films³ and the first complete characterization of PVDF. During this time Mike Haun made a frontal assault upon the phenomenology of ferroelectricity in the PZT family, and developed the constants necessary to characterize intrinsic properties in all phases of the solid solution system.⁴

Practically the advantage of the 1:3 piezoelectric/polymer composite was being authenticated by more detailed modeling assuring us of the real superiority if one could only find an inexpensive route for fabrication. Strong efforts on 0:3s brought us up to NGK piezo-rubber but little beyond. The 3:0 connected safari-type composites were also being explored to yield higher permittivity with much enhanced d_{hg} product. For the morphotropic Navy type doped PZTs we made probably the first full set of measurements down to liquid helium temperature. The objective was to explore the freeze-out of the extrinsic contributions to response. At helium temperature, hard, intermediate, and soft PZT properties all came together and agreed well with the expectation from the thermodynamic phenomenology. The results suggested that the extrinsic contribution rose from ~25 to ~75 percent of total dielectric or piezoelectric response on going from hard to soft ceramics at room temperature.⁵

In the year 1986, Kioshi Okazaki hosted US:Japan #3 at the YKK zip fastener facility in Toyama on the east coast of Japan. This sounds a most unlikely place for a conference, but the company had fantastic conference facilities and were warm and generous hosts. Accommodations for partici-

-- continued on page 5

HISTORY

FERROELECTRICITY: The Final Chapter -- continued from page 4

pants was in a Japan style Inn (Ryokan) at the Toyama Spa and it was very nice to be pampered by all these lovely bowing ladies. Wives were excited to make use of the communal bathing facilities, and their excitement became really intense when they found they had accidentally immersed in the male pool. At Toyama the brief three-minute poster high-light talks were introduced and these have been a popular feature of all subsequent meetings.

In 1986, ISAF 8 was held at Lehigh University with Wallace Smith, Phillips Laboratories, in the chair. Lehigh is probably the best example of a steep gradient university, and one can well understand how Don Smyth and his boys keep so slim and trim dashing up and down all those steps! One of the future trend setting papers at this meeting was by Wallace A. Smith on the fine scale 1:3 polymer ceramic composites for medical ultrasound transducers. The highly innovative dice and fill technique provided an elegant method for making just the right fine scale structure.

US:Japan on Dielectric and Piezoelectric Ceramics returns to USA in 1988 with the meeting at NIST in Washington under Steve Frieman. The organized tour of the Lincoln Center was superb and kept all parties together for good discussion in the buses, discussions aided by excellent champagne. Early in 1989, ONR sponsored an US:Indian meeting in Poona with good participation from Japan also. The program heralded the emergence of ferroelectric thin films on silicon as a real topic for discussion. Following the meeting delegates paid a quick visit to the historic caves in Elora. Discovered by a British army captain out hunting, the caves are an absolute treasure trove of paintings and carvings in the rock. The only puzzle of the trip was why the buses were equipped with square wheels or was it the quality of the roads which supplied such continuous high amplitude bounce. But the journey was certainly worth all the effort.

Later in the year IMF 7 (Saarbrücken) saw the full emergence of thin ferroelectric films as a strong topic, pushing this heretofore very basic science meeting a little towards practical applications. A feature of Saarbrücken that most US participants could only "marvel at" was the munificent generosity of the German government in providing funds to bring major delegations from Russia and Eastern Europe, a stark contrast to the niggardly meanness imposed on virtually all US funding agencies. It was wonderful to chat with many old friends, but desperately sad to hear of the breakup of the academy systems and the disintegration of many of the most prestigious institutes.

I believe there is probably less need to detail the many meetings held in the 1990s as these are probably much fresher in people's minds. US:Japan Dielectric and Piezoelectric Ceramics Meetings were in Kyoto (1990); Maui,

-- continued on page 6

ECAPD-3 PAPERS, Part II

continued from page 4
doped triglycine sulphate crystal
H.V. Alexandru and C. Berbecaru

Physical properties of sol-gel deposited Bi₄Ti₃O₁₂ thin films on Si substrates
M> Alexe, A. Pignolet, S. Senz, and D. Hesse

Hyperfine interactions in PZT solid solutions
R.E. Alonso and A. López-Garzía

Anisotropy of the hole drift mobility in KNbO₃ crystals
P. Bernasconi, I. Biaggio, M. Zgonik, and P. Günter

Mobility of large polarons in Bi₁₂SiO₂₀
I. Biaggio, R.W. Hellwarth, and J.P. Partanen

Electromechanical coupling coefficients of Ba₂NaNb₅O₁₅, KNbO₃ crystals
N.I. Burimov, S.M. Shandarov, and A.A. Titorenko

A dielectric study of the x/65/35 lanthanum modified lead zirconate-titanate series
P. Tilloloy, J.-L. Dellis, M. El Marssi, R. Farhi, and D. Viehland

Features of dielectric properties of SrTiO₃ thin films on microwave
K.A. Dudin, A.B. Kozyrev, E.K. Hollman, A.M. Prudan, and V.E. Loginov

Second harmonic generation (SHG) in K₆Li₄Nb₁₀O₃₀ (KLN) and effect

-- continued on page 6

HISTORY

ECAPD-3 PAPERS, Part II

continued from page 5

of nonstoichiometry

W. Fortin, G.E. Kugel, and D. Rytz

Experimental transient self-focusing in photorefractive

 $\text{Bi}_{12}\text{TiO}_{20}$

N. Fressengeas, J. Maufroy, and G. Kugel

Alternating photocurrents in photorefractive sillenite crystals

A. Gerwens, K. Buse, and E. Krätzig

The investigation of ion shift distribution, different local symmetry coexistence in relaxors by NMR and ESR methods

M.D. Glinchuk, I.P. Bykov, and V.V. Laguta

3D domain mapping in $\text{Sn}_2\text{P}_2\text{S}_6$ uniaxial ferroelectrics based on the photorefractive measurements

A.A. Grabar, A.I. Bercha, V.Yu. Simchera, and I.M. Stoika

Large induced birefringence in rubidium hydrogen selenate

J.P. Salvestrini, L. Guilbert, and M.D. Fontana

Influence of inhomogeneities on the surface potential of locally polarized PZT thick films for printing application

W. Hässler, H. Hülz, and L. Seffner

Ferroelectricity in thiourea $\text{SC}(\text{NH}_2)_2$

Harada Koji and Kinase Wataru

Dispersion of the light scattering intensity in photorefractive ferro-

-- continued on page 7

FERROELECTRICITY: The Final Chapter -- continued from page 5

Hawaii (1993); and Tsukuba, Japan (1995). Kyoto being the old capital of Japan, it was quite natural that the entertainment was also classical. I believe in several instances the performances were quite opaque to western eyes and one could only marvel at the overlaying layers of sophistication in this truly old society.

In Maui, the setting was perhaps just too much fun and there was a certain measure of phase separation! Fortunately things were firmly glued back together in Tsukuba and we look forward to the next meeting in Boston in 1997. In Tsukuba it was exciting to see the very rapid development of piezoelectric power transformers for illumination of the backlit liquid crystal display and the probable emergence of another major new market for piezoceramics.

The ISAF sequence in the 1990s was Illinois (1990); Clemson (1992); Penn State (1994); and Rutgers (1996). For Illinois my recollection is of making the final summary presentations and of the surprising popularity of a viewfoil cobbled up to reflect the power of the "fashion bug" in science. The picture was of voyages of discovery in which boats teeming with scientists were at various stages of their voyages. The good ship "Quasicrystal" was sinking fast with only the stern showing. SS "high Tc" was loaded to the gunnels and beginning to take on water. Rafts were being launched to ferry scientists back to the supersteamer "Ferroelectric Films" still tied up at the quay. This boat was also taking on thousands of stick people rushing down the quay to board. The point I was hoping to make was the real shortage of innovative new ideas and the vary large numbers of highly trained researchers waiting to pounce as soon as a promising new area surfaces. Perhaps the next launching will be the good ship "Smart Materials" sailing under orders from SPIE, and one wonders how that one will fare, and whether ferroelectric films will reach the promised land of large-scale commercial applications.

For Clemson, I think before we trust a next meeting to Gene Haertling we must make sure his electricity bills are fully paid up. For many of my lectures some of the audience are always a little bit in the dark, but for the after dinner talk at Clemson they were truly blacked out. It is a real testament to the quality of South Carolina food that they stayed to the end! Seriously though it was at Clemson that the many promising avenues for ferroelectric thin film applications, DRAM, FRAM, packaging, IR imaging, MEMS etc., were first highlighted for the ISAF.

Penn State (ISAF 9) was like old home week. A time to look back as well as looking forward, to pay tribute to some of the pioneers of the field and to celebrate fifty years of barium titanate. Much to Amar Bhalla's and my relief, the new Scanticon Conference facility at Penn State proved to be

-- continued on page 7

HISTORY

FERROELECTRICITY: The Final Chapter -- continued from page 6

outstanding, the weather was very kind, and we were able to have a final garden party which gave all participants time and space to mix and chat with friends.

In the IEEE committee which oversees ISAFs we were a little worried that a follow-on to Penn State could prove difficult. No need to fear. The organizing genius of Amid Safari, his helpers from Texas Instruments (Attleboro) and a very strong program committee underpinned an outstanding meeting. The venue was very well chosen to keep people together, and the many exhibitors at the meeting provided good centers of interest for lively discussion. Outstanding in my mind was the progress on ultra thin multilayer ceramic capacitors (MLCs) exemplified by the outstanding invited talk of T. Nomura from TDK. To assemble 400 layers 2 mm thick with 0.5 mm internal electrodes in a cofired Yen7R structure is a technological tour de force, but I believe similar capabilities also exist in all three major suppliers in Japan.

IMF 8 in NIST, Washington, DC, was chaired by Dr. Wallace Smith of ONR and continued, I believe, the process evidenced at Saarbrücken of closer integration of application needs to this basic science conference. Examples of such association were talks on the unusual polarization mechanisms in relaxor ferroelectrics coupled to more practical needs in electrostrictive actuators, the fundamental importance of domain phenomena in ferroelectricity and the consequent important extrinsic contributions in dielectric and piezoelectric response. It will be interesting to see if this trend continues in the next IMF 9 in Seoul. Participants in Washington were shocked by the death of Dr. Terutaro Nakamura who collapsed in the elevator at the hotel. Warm tributes to Dr. Nakamura were presented during the final session by G. Kobayashi and Y. Ishibashi.

A very warm and complete surprise for myself was a 70th birthday party during the IMF, put on by the Penn State crew with connivance from my good wife. With so many good friends taking part, I am indeed a lucky man.

I believe an interesting phenomenon of the 1990s has been the steady advance of ferroelectrics into new areas of application, on chip capacitors for ultra high density DRAM and for nonvolatile FRAM; simpler low inductance capacitors for packaging following up the MLCs; steady progress in longwave IR thermal imaging, with the bait of low-cost fully integrated systems leading the charge to automotive applications; the march into the areas of mechanics using smart materials and systems to control vibration and noise from systems, applications which run the full gamut from smart skis to stealth submarines; the current movement into microelectro- mechanical (MEMS) and minimechanical systems based on the very high energy

-- continued on page 8

ECAPD-3 PAPERS, Part II

continued from page 6

electric barium sodium niobate crystals

S.V. Ivanova and T.T. Sultanov

Dielectric, pyroelectric, and piezoelectric properties of tin modified $0.4\text{Pb}(\text{Mg}_{1/3}\text{Nb}_{2/3})\text{O}_3 - 0.3\text{Pb}(\text{Mg}_{1/3}\text{Ta}_{2/3})\text{O}_3 - 0.3\text{PbTiO}_3$ system

S.W. Choi and J.M. Jung

Large-scale inhomogeneous structure onset under electric field in some ferroelectrics with a diffuse phase transition

L.S. Kamzina, A.L.

Korzhenevkii, and N.N. Krainik

$\text{CH}_3)_2\text{Al}(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$ and $\text{C}(\text{NH}_2)_3\text{Al}(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$ mix crystals

L. Kirpichnikova, B. Hilczer, L. Czesniak, and V. Dolbinina

Influence of a subsurface layer to surface pyroelectric potential formation in lithium niobate

L. Kokhanchik and E. Yakimov

The phase diagram of $\text{H}_x\text{Li}_{1-x}\text{NbO}_3$ optical waveguides

Yu.N. Korkishko, V.A. Fedorov, S.M. Kostritskii, and V.V. Nosikov

The use of the effect of "remembering" the dispersive crystalline state in the piezoceramics fabrication technology

A.A. Grekov, S.O. Kramarov, L.M. Katsnelson, Yu. V. Dashko, T.G. Protsenko, A.V. Zhdanov, and A.N. Kovalenko

Dielectric and optical properties of the ferroelectric cyclohexan-1, 1'-diacetic acid

-- continued on page 8

ECAPD-3 PAPERS, Part II

continued from page 7

J. Kroupa, V. Premysl, R. Krupkova, and Z. Zikmund

Pyroelectric response of TGS-PEO composites

J. Kulek, B. Hilczer, and M. Polomska

Optical properties of crystals with a sine spatial modulation of dielectric parameters

O.S. Kushnir, L.O. Lokot, and A.V. Kityk

Study of noncentrosymmetric crystals found in the pineal gland of the brain

S.B. Lang, A.A. Marino, and G. Berkovic

Hysteresis loops in LiTaO₃ films

A. Kanduser and B.B. Lavrencic

Thermally stimulated depolarization current spectra of Ni²⁺ doped NaCl crystals

B. Macalik and M. Suszynska

Photorefractive effect in KNbO₃ crystals in the near infrared spectral range

C. Medrano, M. Zgonik, K. Kitamura, and P. Günter

Intensity dependence of phase shift in photorefractive gratings

N. Kiyoshi, A. Keiji, K. Kenji, and M. Takumi

Fracture features of ferroelectric ceramics

I.A. Parinov and L.V. Parinova

Measurement assurance of computer-assisted complex for dielectric properties research

HISTORY

FERROELECTRICITY: The Final Chapter -- continued from page 7

densities achievable in thin ferroelectric/piezoelectric films. Much is being made possible by the progress in thin film development and processing with the steady lowering of processing time/temperature needs.

With so much to offer, what are the problems, and why do I find in talking with many colleagues in the area a rather widespread deep pessimism? I know that our own basic difficulty is that after very many years in the applied research business we have found that much of the most effective funding of applied research has been through the Department of Defence agencies, particularly ONR, and with the end of the cold war, this must inevitably scale down. Who will take up the slack? NSF can not, its mission is primarily basic research and with a fundamental semi-religious faith in peer review it is not likely to change fast. DoE has major bureaucratic problems compounded by the financial responsibility for the national laboratories who are desperately seeking some firm civil role in the rapidly changing research scene.

US industry has moved very fast to eliminate central research labs and to cut back on long-term programs focusing on immediate development. I think it is a pure pipe dream to believe that they can soon move into the breach. At MRL we have excellent relations with many industries and a significant fraction of the budget is industry money, but it is almost all in small contracts aimed to catch and exploit the crumbs from the current DoD table.

Inevitably, I think we must adjust to what is almost certain to be a slimmer resource base. University administrators must begin to return more of the overhead pie to the demonstrated funding generators. They must learn also to eschew the habit of picking up big names from vanishing industry central labs and begin to streamline and focus more precisely in the areas where the school has demonstrated excellence.

There will, I believe, be a real need for schools to provide positive incentives for cooperative work and interdisciplinary studies, as the scramble for diminishing resources is almost bound to lead to interpersonal rivalry and similar fissiparous tendencies. The world is changing fast and the classical patterns of departmental isolation are out of step with the new needs.

In ferroelectricity, one of our major strengths is that the core group is small enough to be in close personal touch and is underpinned by strong long-lasting friendships and a good measure of mutual trust. For the rougher times which are likely to be ahead, I think we must all work hard to retain this fabric.

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HISTORY

FERROELECTRICITY: The Final Chapter -- continued from page 8

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ECAPD-3 PAPERS, Part II

continued from page 8

Y. Pecherskaya and G. Shlykov

Extending the optical transparency range of LiNbO_3 towards the UV
K. Polgár, A. Péter, I. Fölvári, Zs. Szaller, and O. Szakács

Investigations of photorefractive materials at the University of Joensuu, Finland

V.V. Prokofiev, A.A. Kamshilin, R. Onodera, E. Raita, and T. Jaaskelainen

Measurement of parameters of photoexcited charge carriers in weakly doped sillenites in two-wave mixing experiments

E.V. Mokrushina, Yu.B. Afanasiev, A.A. Nechitailov, A.A. Petrov, and V.V. Prokofiev

Diffuse phase transition on modified ferroelectric $\text{K}_{0.6}\text{Li}_{0.4}\text{NbO}_3$

K. Sambasiva Rao

Ferroelectric and resistivity studies on rare earth modified

$\text{Ba}_6\text{Ti}_2\text{Nb}_8\text{O}_{30}$ ceramics

K. Sambasiva Rao, A.S.V. Subrahmanyam, and S. Murali Mohan Rao

Ferroelectric studies on modified ceramics and $\text{Ba}_2\text{LiNb}_5\text{O}_{15}$

K. Sambasiva Rao and S. Murali Mohana Rao

Microstructural and anomalous resistivity behavior of modified ferroelectric properties of

$\text{Sr}_6\text{Ti}_2\text{Nb}_8\text{O}_{30}$

K. Sambasiva Rao, A.S.V. Subrahmanyam, and S. Murali Mohan Rao

-- continued on page 10

ECAPD-3 PAPERS, Part II

Phase-shifted conductivity in perovskites at high temperature
G.F. Tuthill and V.H. Schmidt

Switching kinetics in ferroelectric thin films: Evolution of domain structure
V.Ya. Shur

In situ investigation of crystallization kinetics in sol-gel PZT films
V.Ya. Shur, A.L. Subbotin, S.A. Negashev, E.B. Blankova, E.A. Borisova, D.A. Pelegov, and S. Trolrier-McKinstry

High field behavior of PZT films with different ordering degree
E.P. Smirnova and A.V. Sotnikov

Pyroelectric and piezoelectric properties of $\text{Sn}_2\text{P}_2\text{S}_6$ crystals
Yu.M. Vysochanskii and M.M. Maior

Donor substitution effect on dielectric and electrostrictive properties of $\text{Pb}_{0.73}\text{Ba}_{0.27}(\text{Zr}_{0.75}\text{Ti}_{0.25})\text{O}_3$ ceramics
Y.K. Hyun, K.Y. Woon, and K.D. Heon

Measurement of the piezoelectric and electrooptic constants of GaPO_4 with a Michelson interferometer
F. Krispel, G. Schleinzler, P.W. Krempel, and W. Wallhöfer

POSTER SESSION**Materials Research**

Thermally stimulated currents in PbTiO_3 thin films
L. Pintilie, M. Alexe, and I. Pintilie

Performance optimization of photorefractive polymers
R. Bittner, K. Meerholz, and C. Bräuchle

Surface strain effects on photorefractive gratings in LiTaO_2 crystals
N.I. Burimov and S.M. Shandarov

Dielectric constant and electrical conductivity of PZT/P(VDF-TrFE) 0-3 composites
H.L.W. Chan, P.K.L. Ng, and C.L. Choy

Synthesis and ferroelectric properties of lanthanum modified 0-625PMT-0.325PT-0.05PZ system
K.B. Kim, Y.H. Park, and S.W. Choi

Reduction-oxidation treatment of photorefractive potassium niobate
M. Ewart, M. Zgonik, P. Günter, and P. Cevc

Domain formation in thin ferroelectric films: The role of depolarization energy
A. Kopal, T. Bahnik, and J. Fousek

Structural and electrical properties of LiTaO_3 thin films grown on silicon by modified molecular beam epitaxy
F. Gitmans, Z. Sitar, Y. Tao, H. Pierhöfer, and P. Günter

New piezoelectric ceramics on the base of $\text{BiZn}_{1/2}\text{Zr}_{1/2}\text{O}_3\text{-PbTiO}_3$ system
S.A. Gridnev and S.P. Ostapenko

Flexure-electrical properties of perovskite ceramics
S.A. Gridnev

Pyroelectrical homogeneity of corona-charged P(VDF/TrFE) films
B. Hilczler and J. Kulek

Effect of additives on microwave dielectric properties in low firing (Mg, Ca) TiO_3 based ceramics
I. Naboru and Y. Hirobumi

Dielectric and ferroelectric properties of pulsed laser deposited films of BaTiO_3 PZT and PLZT
R. Kullmer and M. Tyunina

Electron emission from ferroelectric thin films
D. Averti, J.L. Chartier, D. Jézéquel, and R. Le Bihan

RF magnetron sputtering of SrTiO_3 and $(\text{BaSr})\text{TiO}_3$ thin films and their dielectric properties
B.M. Goltsman and V.V. Lemanov

Electric field induced cracking in PLZT ceramics
A. Levstik, C. Filipic, V. Bobnar, and M. Kosec

Surface structure of bulk and thin film ferroelectrics
K. Okazaki and H. Maiwa

Growth and properties of bismuth tellurite Bi_2TeO_5
A. Péter and I. Fölvári

New semiconducting substrate for heteroepitaxial growth of $\text{K}_{1-y}\text{Na}_y\text{Ta}_{1-x}\text{Nb}_x\text{O}_3$ (KNTN)
H. Pierhöfer, Z. Sitar, F. Gitmans, H. Wüest, and P. Günter

Large area pulsed deposition of Aurivillius-type layered perovskite thin films
A. Pignolet, S. Welke, C. Curran, M. Alexe, S. Senz, and D. Hesse

GORDON AND BREACH NEWS

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ECAPD-3 PAPERS, Part II continued from page 10

In-situ growth of PbTiO₃ thin films
on GaAs substrates

*B. Jaber, P. Tronc, D. Rémiens,
B. Thierry, and H. Chaouch*

Processing and characterization of
piezo/ferroelectrics in the

Stillwellite family
*S. Yu. Stefanovich, B.V. Mill, and
V.N. Sigaev*

CONFERENCE REPORTS

ISAF'96 PAPERS, Part I

The following is Part I of the titles and authors of presentations given at the **Tenth International Symposium on the Applications of Ferroelectrics, held 18-21 August 1996 at East Brunswick, New Jersey.** Part II will be published in the Summer 1997 issue.

Plenary Presentations

Two-dimensional arrays for medical ultrasound

S.W. Smith

Ferroelectric nonvolatile memory technology with bismuth layer structured ferroelectric materials

Koji Arita

Flat panel displays: How bright and colorful is the future?

P.H. Hollaway

Multilayer ceramic capacitors: Recent trends and issues

Takeshi Nomura

Ultrasonic Imaging

Integrated ferroelectric monomorph transducers for acoustic imaging

J. Bernstein, K. Houston, L. Nilse, H.D. Chen, K. Li, and L.E. Cross

Electrostrictive transducers for medical ultrasonic applications

J. Chen, A. Shurland, J. Perry, B. Ossman, and T.R. Gururaja

Development and fine-scale piezoelectric ceramic/polymer composite via fine-scale PZT fibers

B. Jadidian, V.F. Janas, A. Safari, J.D. French, G.E. Weitz, J.E. Luke, and R.B. Cass

High-frequency piezoelectric properties of fine-grained PZT

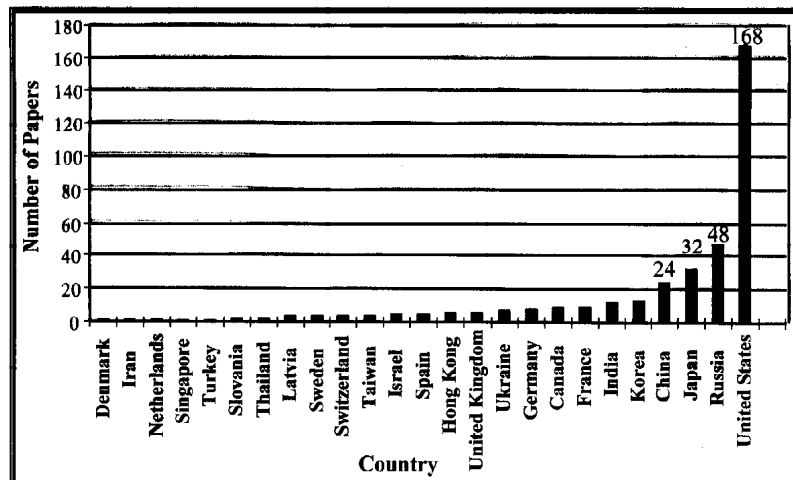
TENTH INTERNATIONAL SYMPOSIUM ON THE APPLICATIONS OF FERROELECTRICS (ISAF'96)

The ISAF'96 was held 18 - 21 August 1996 at the Brunswick Hilton and Towers, East Brunswick, New Jersey. Hosted by Rutgers University and sponsored by the Institute of Electrical and Electronic Engineers - Ultrasonics, Ferroelectrics and Frequency Control Society (IEEE-UFFC), it was financially supported by the Office of Naval Research, the Army Research Office, the Advanced Research Projects Agency, and the Howatt Foundation at Rutgers University. Other sponsoring organizations were the New Jersey Commission of Science and Technology, the College of Engineering and the Center for Ceramic Research at Rutgers University. **Prof. A. Safari** of the Department of Ceramic Engineering at Rutgers was General Chair of the symposium.

The 1996 symposium was the tenth in a series begun in 1968 by the IEEE Committee on Ferroelectrics. Each subsequent symposium has been larger and more diverse in topics covered, reflecting the growth in ferroelectric research. ISAF'96 had 400 attendees, among them 100 graduate students. More than 130 participants came from outside the United States, including more than 50 from the Far East and 50 from Europe and Russia. Representatives from industry, academia, and government organizations provided an excellent balance between fundamental research and development on one hand, and applications of ferroelectric materials and devices on the other. In addition, 16 exhibitors set up booths at the symposium to display the latest developments in the production and application of ferroelectrics.

Dr. Ray Gururaja of Hewlett-Packard and **Prof. Tom Shrout** of Pennsylvania State University were responsible for putting the program together. More than 360 oral and poster presentations covered a wide variety of topics, such as ultrasonic imaging, electrooptic devices, processing, energy storage,

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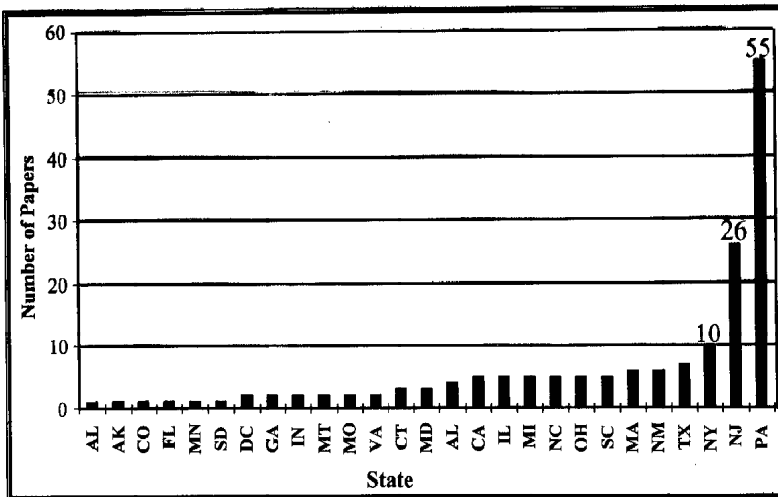
CONFERENCE REPORTS

ISAF'96 -- continued from page 12

infrared imaging, microelectromechanical systems, novel applications, electromechanical controls, characterization, and transducers & composites.

Drs. Bernard Kulwicki and **Ahmed Amin** of Texas Instruments served as editors of the proceedings, which contain more than 300 papers. Each of these papers was reviewed prior to or during the symposium, and critical comments and recommendations were conveyed to the authors for further modification.

Geographic Distribution - United States



In addition to the symposium, attendees were treated to a reception on Sunday evening and a banquet at the Hilton on Monday evening. An outdoor picnic was organized on Tuesday evening at the Rutgers University log cabin. A full program for spouses was arranged with sightseeing in New York City and Princeton, as well as a Broadway show.

The success of the symposium was the result of the sincere hard work of various groups of people, including faculty, staff, graduate and undergraduate students of the Department of Ceramic Engineering at Rutgers and stands as an excellent record of the efforts of everyone affiliated with ASAF '96.

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ISAF'96 PAPERS, Part I

-- continued from page 12

M.J. Zipparo, K.K. Shung, W. Hackenberger, and T.R. ShROUT

Dynamic properties of 2-2 PZT-polymer composites

C. Richard, D. Guyomar, and L. Eyraud

Can relaxor materials overcome PZT?

Y. Yamashita

Crystal growth and ferroelectric related properties of (1-x)

$\text{Pb}(\text{Zn}_{1/3}\text{Nb}_{2/3})\text{O}_3 - x \text{PbTiO}_3$

S.-E. Park, M. Mulvihill, G. Risch, M. Zipparo, and T.R. ShROUT

Dielectric and piezoelectric response of sol-gel composites for ultrasonic applications

M. Sayer, J. Beckett, and M. Lukacs

Thin film ZnO ultrasonic transducers for tissue characterization

Y. Ito, K. Yokosawa, S. Sano, R. Shinomura, and Y. Sato

Ferroelectric nylon-5 and nylon-7 dielectric and electromechanical properties and ultrasonic transducer performance

L.F. Brown, J.L. Mason, M.L. Klinkenborg, J.I. Scheinbeim, and B.A. Newman

Memory

MOCVD growth and characterization of Pb-based ferroelectric thin films

T. Shiosaki, H. Fujisawa, and M. Shimizu

-- continued on page 14

CONFERENCE REPORTS

ISAF'96 PAPERS, Part I

-- continued from page 13

Resistance degradation of CVD
(Ba,Sr) TiO₃ thin films for DRAMs
and integrated decoupling capacitors

*C. Basceri, S.K. Streiffer, A.I.
Kington, S. Bilodeau, R. Carl,
P.C. van Buskirk, S.R.
Summerfelt, and P. McIntyre*

Preparation of barium strontium
titanate thin film capacitors on
silicon by metallorganic decomposi-
tion

*A.B. Catalan, J.V. Mantese, A.L.
Micheli, N.W. Schubring, R.J.
Poisson, and W. J. Baney*

Electron cyclotron resonance
plasma development and study of
high permittivity strontium titanate
thin films

S.B. Krupanidhi

Pulse switching characterization of
Sr Bi₂Ta₂O₉ thin films for low
voltage nonvolatile memories

*D.J. Taylor, R.E. Jones, Jr.,
P. Zurcher, P. Chu, S. Zafar,
B.E. White, Jr., and S.J. Gillespie*

Integration of ferroelectric capaci-
tors using multilayered electrodes

I. Chung

BaSrTiO₃ thin films for integrated
high frequency capacitors

*G.T. Stauf, S. Bilodeau, and
R.K. Watts*

Integration and modeling of ferro-
electric nonvolatile memories

*P. Zurcher, R.E. Jones, Jr., B.
Jiang, P. Chu, D.J. Taylor, B.E.
White, Jr., S. Zafar, and S.J.
Gillespie*

Fabrication of MFIS-FETs using

9TH INTERNATIONAL SYMPOSIUM ON ELECTRETS (ISE 9)

The DEIS-sponsored 9th International Symposium on Electrets (ISE 9) was held on 25 -27 September 1996 at Tongji University, Shanghai, and on 30 September 1996 in the Main Hall of the Confucius Temple in Jiading County near Shanghai, China. The conference was organized by the Electrets Group of the Pohl Institute of Tongji University with **Prof. Xia Zhongfu**, **Prof. G.M. Sessler** (Germany), and **Prof. R.J. Fleming** (Australia) acting as chairman and vice chairmen, and **Dr. Zhang Hongyan** acting as secretary, respectively.

A total of 126 participants from 21 countries and regions, representing four continents, attended the symposium. The distribution of attendees according to continents was as follows:

Asia	83	64%
Europe	40	32%
South America	2	2%
Australia	1	1%

The strongest delegations came from these three countries:

China	55	44%
Japan	21	17%
Germany	16	13%

In response to the call for papers, a total of 288 contributions from 26 countries and regions were offered. The large number of papers necessitated the extensive use of poster presentations. Of the papers accepted, 56 papers were selected as invited or regular oral presentations, and 110 as posters. One hundred and ninety-five manuscripts were collected in the ISE 9 proceedings.

The invited lecture, "Silica-based nanocomposites," by **Prof. Yao Xi** from Xi'an Jiaotong University, China, opened the symposium. The program covered the following nine sessions:

- Charge storage, transport, and recombination
- Charging techniques and charge profiles
- Photoelectrets and optical properties of dielectrics
- Nonlinear effects
- TSD and relaxation phenomena
- Thin films, interfacial phenomena, and nanometric dielectrics
- Bioelectrets
- Ferro-, piezo-, and pyroelectricity
- Applications

Among the highlights of these sessions were six more invited lectures:

CONFERENCE REPORTS

ISE 9 -- continued from page 14

N. Hozumi (Nagasaki, Japan), "Space charge behavior in electrical insulation under high field"

R. Gerhard-Multhaupt (Potsdam, Germany), "Nonlinear optical polymer electrets"

Furukawa (Tokyo, Japan), "Nonlinear dielectric effects in polymers and glass-forming liquids"

D. K. Das-Gupta (Bangor, United Kingdom), "Piezo- and pyroelectricity in polymer electrets and their applications"

W. Eisenmenger (Stuttgart, Germany), "Charge-dipole interaction in polymer electrets"

J. Lewiner (Paris, France), "Evolution of electret applications"

In line with the previous meeting of this series, the technical program encompassed new developments in the areas of charge storage and transport, charging techniques and charge profiles, nonlinear effects, bioelectrets, and their applications. Judging from the number of contributions, piezo-, pyro- and ferroelectric polymer electrets--and in particular inorganic polymeric composite materials--were of significant scientific and technical interest. Some novel research fields, including molecular electrets, nanometric dielectrics, Langmuir-Blodgett films and self-assembled monolayer films, aerogel films, and their properties were also of interest.

Two workshops, "The future of electrets" and "Surveys on ongoing electrets", were held in the Main Hall of the Confucius Temple in Jiading County on 30 September. The Confucius Temple, a memorial to the early Chinese educator and philosopher Confucius, built 777 years ago, is a magnificent building known as "No.1" in East China. The two workshops benefited greatly from the congenial atmosphere of the combination of Chinese and Western cultures, and of ancient and modern academic exchanges. At the first workshop, chaired by B. H. Hilzer (Poland), a special panel discussion included the following topics:

- The ever changing definition of electrets
- Molecular electrets
- The appeal of electrets to science and engineering
- Miniature electret microphone of the future

At the second workshop, chaired by R. Gerhard-Multhaupt (Germany), scientists from Central, Western, and Eastern Europe, Australia, Africa, Eastern, Southern, and Western Asia, and China delivered lectures on "Surveys on ongoing electrets."

A special issue of the *IEEE Transactions on Dielectrics and Electrical Insulation* will be dedicated to the topics of ISE 9. The guest editors, Prof. Sessler, Prof. Fleming and Prof. Xia, will invite authors to submit papers.

ISAF'96 PAPERS, Part I

-- continued from page 14

PLZT/STO/Si(100) structures

E. Tokumitsu, R. Nakamura, and H. Ishiwara

Epitaxial SrBi₂Nb₂O₉, Pb₂Bi₂Nb₂O₉ films: Features of growth and dielectric parameters

Y.A. Boikov, Z.G. Ivanov, E. Olsson, T. Claeson, D. Erts, and I. Pronin

Low temperature preparation of fatigue free Bi₄Ti₃O₁₂ thin films by MOCVD and their electrical properties

T. Kijima, M. Nagata, and H. Matsunaga

Effects of film thickness and process parameters on the properties of SrBi₂Ta₂O₉ ferroelectric capacitors for nonvolatile memory applications

P.Y. Chu, D.J. Taylor, P. Zurcher, B.E. White, Jr., S. Zafar, B. Jiang, R.E. Jones, S.J. Gillespie, and W. Chen

Size effects in barium titanate thin film heterostructures with conductive oxide electrodes

J.P. Maria, S. Trolier-McKinstry, D.G. Schlom, and J. Lannin

Epitaxial PLT thin films for memory applications

A. Kushwaha, R. Gerhardt, Y. Kim, and A. Erbil

Growth behavior of LaNiO₃ layers and their effect on the pulsed laser deposited (Pb_{1-x}La_{2x})(Zr_yTi_{1-y})O₃ thin films

I.N. Lin, T.F. Tseng, K.S. Liu, and T.B. Wu

-- continued on page 16

-- continued on page 16

CONFERENCE REPORTS

ISAF '96 PAPERS, Part I

-- continued from page 14

Electrooptic Devices

Materials issues in holographic data storage

B. A. Wechsler

Optimum parameters in the design of electrooptic waveguide modulators using ferroelectric thin films

*E. Dogheche, D. Remiens, and B. Thierry*Processed Pb(Zr, Ti)O₃ thin films*M.B. Sinclair, B.G. Potter, Jr., and D. Dimos*

Stress-induced effect in PLZT ceramics

G.H. Haertling

Trapping laser beams in ferroelectric crystals

G. Salamo

Part II of the ISAF '96 papers will be published in the Spring 1997 issue. The following topics will be covered:

- *Electrooptic devices/displays*
- *Electromechanical control: Novel applications, relaxors, materials, MLAs and drives*
- *Microelectromechanical systems*
- *Infrared imaging*
- *Sensors*
- *Transducers and composites*
- *Wireless*
- *Energy storage*
- *Characterization*
- *Processing/Novel manufacturing*
- *Novel applications*

ISE 9 -- continued from page 15

The ISE 9 Scientific Advisory Committee held meetings in the evening of 24 September and during lunch on 30 September. Among others, the following resolutions were adopted:

1. It was proposed that an Electret Award should be established. After a long discussion it was agreed that this award should be given to an outstanding young scientist and should be used to improve the overall quality of poster contributions.
2. Professor Bernhard Gross was made a permanent Honorary Member of the ISE Scientific Advisory Committee.

As a complement to the tight schedule, the local committee organized three guided two-day sightseeing tours during the weekend of 28 - 29 September. Many conference participants, mostly those from abroad, went to Hangzhou and West Lake, Wuxi and Taihu Lake, Suzhou, or downtown Shanghai. They were most impressed by these beautiful sights of China.

The Chinese organizers are grateful to **Dr. Bulinski, Prof. G.M.Sessler, Prof. R.J. Fleming** and **Prof. R. Gerhard-Multhaupt** for their competent advice before and during the symposium.

The Tenth International Symposium on Electrets (ISE 10) will be held in Delphi, Greece, toward the end of September 1999, chaired by Professor Amalia A. Konsta (Physics Department, National Technical University of Athens, Zografou Campus, 15780 Athens, Greece).

Xia Zhongfu
Professor, ISE Chairman

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UPCOMING MEETINGS**Seventh International Seminar on Ferroelastic Physics (ISFP-7)****25 - 27 June 1997****Kazan, Russia**

The rapid development in materials research, device research, and understanding of basic properties of ferroelastics and polar dielectrics, furthermore the quality of work in this field, more than justify the decision that the seminar series should be continued after Voronezh '94.

Topics

- Phase transitions and critical phenomena
- Lattice dynamics, lattice instability, and soft modes
- Structure and crystal growth
- Domains, domain boundaries, and imperfections
- Acoustic and ferroelastic properties
- Radiospectroscopy and optical properties
- Superionic conductivity in ferroelastics
- Ferroelasticity and superconductivity
- Modulated and incommensurate systems
- Disordered and glassy systems
- Sensors, transducers, actuators, integrated optics, electrooptic modulators, spatial light modulators, displays, optical signal processors, smart sensors

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Deadline for Submission of Abstracts

15 March 1997

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UPCOMING MEETINGS**ISAF XI, ECAPD IV, and Electroceramics VI**
24 - 27 August 1997*
Congress Centre Montreux, Switzerland

The three international conferences, **International Symposium on Applications of Ferroelectrics (ISAF XI)**, **European Conference on Applications of Polar Dielectrics (ECAPD IV)**, and **Electroceramics VI**, have complementary scopes. For the first time these three conferences will take place simultaneously at the same location.

Topics**ECAPD and ISAF**

- Active control, adaptive structures, and smart systems
- Biomedical applications and ultrasonic imaging; composite materials; high coupling coefficient materials
- Bulk piezoelectric and electrostrictive materials for sensor and actuator applications
- Electrooptics, displays, and other optical applications; liquid crystals
- Ferroelectric and piezoelectric thin film devices; microsystems; microsensors and microactuators; integrated ferroelectrics
- Ferroelectric thin films for memory applications; fatigue processes
- High permittivity dielectrics for microwave applications; materials for energy storage and applications
- PVDF, copolymers, and other polar organic materials; ferroelectricity in biological systems
- Pyroelectrics and thermal imaging
- Recent progress in basic studies: theoretical and experimental; domain wall processes; thermodynamics, phase transitions; modeling of thin film properties
- Relaxors; disordered systems

Electroceramics VI

- Dielectric materials, devices, and applications; electronic packaging
- Ferroelectric, piezoelectric, and pyroelectric bulk and thin film materials; processing and applications
- Grain boundary controlled processes and devices
- Ionic and electronic conductors
- Magnetic materials, devices, and applications
- Multilayer structures; composite materials
- Optical ceramics; photonics
- Processing, sintering, and microstructure development of electroceramics
- Superconductors
- Thin film processing; sol-gel; sputtering; MOCVD
- Transport phenomena; defects; diffusion; electric conductivity
- Novel manufacturing methods, devices, and applications

Contact

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* - Correction: These three conferences will take place in **1998**, not 1997. Sorry for the confusion.

UPCOMING MEETINGS**Second European Meeting on Integrated Ferroelectrics (EMIF-2)****29 September - 1 October 1997****Jouy-en-Josas, Campus Thomson, France**

Following EMIF-1, which was held in Nijmegen in July 1995, EMIF-2 will take place at the Campus Thomson near Versailles. The conference, organized by the Groupe Français de la Céramique (GFC) and the Société des Electriciens et des Electroniciens (SEE) under the auspices of the European Ceramic Society, will be a two-day, two-session meeting with invited and contributed papers on processing and applications of integrated ferroelectrics.

Topics

- Thin film deposition
- Electrodes and interfaces
- Microstructure and characterization
- Dielectric, ferroelectric, piezoelectric, and optical properties
- Epitaxial structures
- Domains and switching
- Processing and integration
- Memory devices
- Thin film sensors and actuators
- Thin film optical devices

Scientific Program Committee

J.P. Ganne (Orsay); P. Gaucher (Orsay); P.K. Larsen (Eindhoven); V.V. Lemanov (St. Petersburg); J. Mendiola (Madrid); K.V. Rao (Stockholm); Th. Rasing (Nijmegen); N. Setter (Lausanne); R. Waser (Aachen); W. Wersing (München); R. Whatmore (Cranfield)

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Deadline for Submission of Abstracts

1 March 1997

Contact

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**For current information on ISIF 97
see the Web home page
<http://www.sp.nps.navy.mil>**

CALENDAR OF EVENTS 1997

Mar 2-5	• ISIF 97, Santa Fe, New Mexico, (see <i>Ferroelectricity Newsletter</i> , Vol. 4, No. 3, p. 10)
Mar 31- Apr 4	• MRS 1997 Spring Meeting, San Francisco, California. Information: Linda G. Cima, Massachusetts Institute of Technology, phone +(617) 253-0013, fax +(617) 258-8224, e-mail lgcima@athena.mit.edu; David J. Eaglesham, AT&T Laboratories, phone +(908) 582-3768, fax +(908) 582-4228, e-mail dave@physics.att.com; Alexander H. King, State University of New York, Stony Brook, phone +(516) 632-8499, fax +(516) 632-9528, e-mail aking@boundaries.eng.sunysb.edu
Apr 14-15	• COST 514 Workshop on Ceramic Ferroelectric Thin Films, University of Parma, Italy. Information: Fabrizio Leccabue and Bernard E. Watts, Istituto Maspec/CNR, Via Chiavari 18a, 43100 Parma, Italy, fax +39-521-26 92 06, e-mail leccabue@prmasp.bo.cnr.it
May 28-31	• FMA-14, Coop-Inn Kyoto, Kyoto, Japan
Jun 1-4	• 15th Conferenc on Crystal Growth and Epitaxy, Stanford Sierra Camp, Fallen Leaf Lake, California, (see <i>Ferroelectricity Newsletter</i> , Vol. 4, No. 4, p. 22)
Jun 25-27	• 7th International Seminar on Ferroelastic Physics (ISFP-7), Kazan, Russia, (see p. 17)
Jul 6-11	• Gordon Research Conference on Crystal Growth and Epitaxial Thin Films. Information: phone +(401) 783-4011/3372, fax +(401) 783-7644, e-mail app@gremail.grc.uri.edu
Aug 24-27	• ISAF XI, ECAPD IV, and Electroceramics VI, Montreux, Switzerland, (see p. 18) *
Aug 24-29	• 9th International Meeting on Ferroelectricity (IMF-9), Seoul, Korea (see <i>Ferroelectricity Newsletter</i> , Vol. 4, No. 3, p. 10)
Sep 29- Oct 1	• 2nd European Meeting on Integrated Ferroelectrics (EMIF-2), Jouy-en-Josas, France, (see p. 19)

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