Ferroelectricity Newsletter

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

Volume 4, Number 4 Fall 1996

FALL ISSUE HIGHLIGHTS EUROPEAN ACTIVITIES

When it comes to conference reports and papers presented at meetings, this issue can be declared a European one. Starting on page 2, you will find the titles and authors of presentations delivered at the **3rd European Conference on Applications of Polar Dielectrics**, held 26-29 August 1996 in Bled, Slovenia.

Then the focus shifts to the **Fifth International Conference on Electronic Ceramics and Applications**, referred to as **Electroceramics V**, which took place from 2 - 4 September in Aveiro, Portugal. **Professor Rainer Waser** from RWTH Aachen University of Technology in Germany teamed up with his U.S. colleague **Professor Angus I. Kingon** from North Carolina State University to bring us an account of the important features at this conference, which attracted 228 participants from 26 countries.

A major part of this issue is devoted to the list of papers given at **Electroceramics V**. In the past we have received many requests for further information on presentations made at Electroceramics IV. We therefore assume that this list is particularly useful to our readers.

Last year the Advisory Committee of the International Symposium on Integrated Ferroelectrics tackled the question of finding an umbrella name for the wide variety of solution-based chemical processing techniques for the synthesis of electroceramic thin films. **Rainer Waser**, together with **Robert W. Schwartz** from Sandia National Laboratories in Albuquerque, New Mexico, assumed the task of circulating an opinion poll among the R&D groups active in the field in order to come up with an appropriate terminology. The result of their efforts is presented on page 2.

The ***mailbox*** of this year's Spring issue had a short notice from **Alex Freeman** from the University of Texas at Arlington about an important monograph for researchers in ferroelectricity. About the same time we talked about an additional feature of the ***Ferroelectricity Newsletter***: book reviews. We asked Alex Freeman if he would be willing to premiere this feature, he said yes, and here it is on page 4.

As usual, the Fall issue contains an index of upcoming meetings, conference reports, scientific papers, and special reports published in the current volume. Look for it on page 23.

-- Rudolf Panholzer
Editor-in-Chief

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Ferroelectricity Newsletter

Volume 4, Number 4
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ECAPD-3 PAPERS

The following is Part I 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 II will be published in the Winter 1997 issue.*

Transfer from research to industry: The example of PVDF underwater transducers
F. Micheron

Printing with ferroelectric ceramics
A. Hirt

Piezoelectric coating for active optical fiber devices
G.R. Fox, C.A.P. Muller, C.R. Wüthrich, N. Setter, and H.G. Limberger

The use of thin sputtered PZT films for moving micromechanical structures with nanometric precision
D.F.L. Jenkins, M.J. Cunningham, W.W. Clegg, G. Velu, and D. Remiens

Analytical electron microscopy of ferroelectric ceramic materials
G. Drazic and M. Kosec

On the dielectric constant of strained layers of $BTiO_3$
M.J.H. Niesten, N.J. Pulsford, J.F. M. Cillessen, and C.W.T. Bulle

Phenomenology of relaxor ferro-electrics
B.E. Vugmeister

Comparison of dc and ac field effects on dielectric properties of lead magnesium niobate relaxor

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TERMINOLOGY

CHEMICAL SOLUTION DEPOSITION

During the past decade, a wide variety of solution-based chemical processing techniques for the synthesis of electroceramic thin films have been successfully developed. Unique names are used to describe these techniques depending on the manner in which the solution is prepared (e. g., sol/gel, MOD = metal organic decomposition, hydrothermal routes, hybrid sol/gel methods) and the way in which the lay-down is accomplished (e. g., spin-on, dip-in, mist coating, electrochemical formation, etc.). Despite the large number of approaches, no ”umbrella” or blanket name has been accepted for all these commonly used techniques. In contrast, vapor phase deposition techniques have for many years had well-established umbrella names. Physical Vapor Deposition (PVD), for example, comprises PLD, sputter deposition, ion beam deposition, Oxi-MBE, etc., while the Chemical Vapor Deposition (CVD) comprises MOCVD, PECVD, etc.

On behalf of the Advisory Committee of the International Symposium on Integrated Ferroelectrics, at the end of last year we began an attempt to define such an umbrella term by circulating an opinion poll among the R&D groups active in the field. Criteria for the search of an appropriate umbrella name were the following:

(1) Restriction to thin film deposition techniques only (as PVD and CVD), not including sol-gel methods for powders, etc.

(2) Independence of the lay-down techniques (spin-on, dip-in, spray-on, etc.).

(3) Clear distinction from high-temperature, physical melt phase processes, such as Liquid Phase Epitaxy (LPE).

(4) Clear distinction from powder-based thick film and foil techniques that employ suspensions and slurries into which prereacted powders are introduced.

(5) Taking into account that chemical reactions occur on the way from the deposited solution to the final ceramic film (chemical reactions occur of course throughout the film and not at the interface as in the case of CVD).

(6) Recognizing that no umbrella name can be absolutely exact but it should be sufficient to cover the vast majority of the processes discussed. (One should remember that the boundary between PVD and CVD is also not exact. There are a few processes which could be labeled under either umbrella.)

(7) A suitable acronym length. Three letters would compare best with the other umbrella names PVD and CVD.

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TERMINOLOGY

CHEMICAL SOLUTION DEPOSITION-- continued from page 2

Based on these criteria, suggestions were collected and distributed in the opinion poll. Our request was sent to more than 30 groups and individuals worldwide, of which two thirds responded. The vast majority strongly supported the idea to establish some kind of umbrella name, and of many suggestions, the name **Chemical Solution Deposition (CSD)** was selected by more than 80 percent of the respondents, in several cases with enthusiastic comments! The term solution in this name is, of course, used in its general sense and regarded to comprise colloidal solutions, oligomeric and polymeric solutions, as well as complex and simple solutions.

Of course, the umbrella name is not intended to replace the unique names mentioned above. The unique names (MOD, sol/gel, etc.) will be used when a specific process description is presented.

The term solution in Chemical Solution Deposition (CSD) is used in its general sense and regarded to comprise colloidal solutions, oligomeric and polymeric solutions, as well as complex and simple solutions.

It is further anticipated that in the future additional individual names may be created, as new methods in the field arise. However, when a number of the specific techniques are mentioned or discussed, we encourage everyone to make extensive use of the new umbrella name, CSD.

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ECAPD-3 PAPERS --continued from page 2

A.E. Glazounov and A.K. Tagantsev
Depolarization field as a driving force of fatigue in PZT ferroelectric thin films
V.V. Lemanov and V.K. Yarmarkin

The application of nonlinear dynamics in the study of ferroelectric materials
S. Blochwitz, R. Habel, M. Diestelhorst, and H. Beige

Off-axis laser deposition and characterization of $Ba_{1-x}Sr_xTiO_3$ thin films
K. Kämmer, B. Holzapfel, H. Hülz, and W. Hässler

Oxidation and reduction treatment of perovskites in science and technology
H. Arend

POSTER SESSION
Device Research, Optics
Multifrequency transducers fabricated using PZT/P(VDF-TrFE) 1-3 composite
K.W. Kwok, H.L.W. Chan, and C.L. Choy

Pyroelectric devices based on sputtered PZT thin films
R. Köhler, N. Neumann, M. Schreiter, W. Wersing, R. Bruchhaus, N. Hess, and M. Simon

Nonconventional piezoelectric sensors using resonators with bulk- and surface acoustic waves
J. Nosek

Temperature-sensing quartz strip
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ECAPD-3 PAPERS --continued from page 3

resonantors
J. Nosek and J. Zelenka

PLZT ceramics electrooptic modulators for infrared solid state Nd:YAG and Er:YAG lasers
M. Ozolinsh, K. Stock, R. Hibst, R. Steiner, and T. Meijer

Q-switching of Er:YAG (2.9μm) solid state laser by PLZT electrooptic modulator
M. Ozolinsh, K. Stock, R. Hibst, and R. Steiner

Use of school PLZT ceramics modulator with Ar^+ laser: Electrooptic effect and writing of holographic patterns
M. Ozolinsh, M. Zarins, M. Reinfelde, and H. Porschen

Feasibility of quartz temperature and pressure sensors
L.P. Pereverzeva and Y.M. Poplavko

Acoustic wave analysis of thickness and piezoelectric transducers
R. Pérez, A. Albareda, J.L. Villar, and E. Minguella

Electrical matching effect on the piezoelectric transduction performance of a trough-transmission pulsed process
A. Ramos, J.L. San Emeterio, and P.T. Sanz

Influence of material damping over the shift of the resonance/antiresonance frequencies in thickness-mode piezoelectric ceramic resonators
J.L. San Emeterio

Piezoelectric polymer actuator

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BOOK REVIEW

PRINCIPLES AND APPLICATIONS OF FERROELECTRICS AND RELATED MATERIALS
by **M.E. Lines and A.M. Glass**
Clarendon Press, Oxford, 1977, 680 pages
ISBN 0-19-851286-4

This book, written a couple of decades ago, is nevertheless a comprehensive source of information on ferroelectrics. Although a lot of research is now being conducted in this field, this volume still is an excellent reference for researchers somewhat familiar with ferroelectrics.

It begins with a historical perspective of ferroelectrics in a very readable form. The second chapter takes the statistical mechanics approach and goes into the static and dynamic mean field theory, including the Ising model. The macroscopic thermodynamic approach is taken in the third chapter to contrast with the statistical approach. Much of these two chapters is theoretical, which makes me think that they should have been introduced after Chapter 11.

The theoretical foundations of the preceding chapters have dealt with uniform infinite ferroelectrics. In real crystals, important additional considerations arise owing to the presence of crystal surfaces and imperfections and these are discussed in Chapter 4. Chapter 5 is devoted to the experimental studies relating electric displacement (D), entropy (S), and strain (X) to the electric field (E), temperature (T), and stress (X). In Chapters 6 and 8 the structural crystallography is introduced followed by the unit cell mechanics and its effects on the physical properties of various important materials.

Chapter 9 demonstrates the manner in which ionic motion in a double-well local potential can be cast theoretically in the language of cooperative magnetism. The soft mode behavior in ferroelectrics is studied using IR techniques in Chapter 7 and the coupling of this soft mode to the polarization particularly near the Curie point is described in Chapter 10. Chapter 12 gets further into the NMR and spectroscopic tools available for the measurement of local crystal symmetry and of local vibrational motion in ferroelectrics. Chapter 13 surveys nonlinear optics issues, such as electrooptics and optical mixing and discusses the phenomenological and microscopic theories. Chapter 11 stands alone in describing the recent theories of critical phenomena and how they approach the thermodynamic singularities near Curie point.

A flurry of activity is going on in semiconductor piezoelectrics and ferroelectrics due to the developments in MEMS processes. A brief description of semiconductor ferroelectrics like antimony sulphoiodide, germanium telluride is given in Chapter 14. Chapter 15 mentions the materials issues of thin films and bulk ceramics and polymer pyroelectrics. The final chapter talks about the ferroelectrics applications pertaining to pyroelectric detectors,

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BOOK REVIEW

PRINCIPLES AND APPLICATIONS OF FERROELECTRICS AND RELATED MATERIALS -- continued from page 4

memories, and electrooptic modulators.

The book should be approached as reference material, not as a textbook. It does a good job of covering a wide range of theoretical topics. As far as applications goes, current literature should be consulted for recent developments.

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NEW GORDON AND BREACH PUBLICATION

Last August, Editor-in-Chief **George W. Taylor** announced the launch of ***Ferroelectrics Communications***, a new companion journal to ***Ferroelectrics, Ferroelectrics Letters Section***, and ***Integrated Ferroelectrics***.

Ferroelectrics Communications is a bimonthly rapid-communication publication targeted to academic and industrial researchers in the field of ferroelectrics and related materials. Because of the widespread posting of submitted papers on bulletin boards having specialized circulation, there is currently considerable debate within the community regarding both the value and the treatment of such unrefereed "publications." ***Ferroelectrics Communications*** will make available the abstracts and references of **all** papers submitted to ***Ferroelectrics, Ferroelectrics Letters Section***, and ***Integrated Ferroelectrics***. In addition, authors may make available a preview of their results in refereed **Synoptics**. Thus authors have the opportunity to announce their work while it is being refereed for publication. The dual purpose is to speed communication within the community and provide researchers with the means of establishing the priority of their work.

Ferroelectrics Communications is available in paper form and will also be accessible (with selected contents) via the Gordon and Breach home page on the World Wide Web. All **Abstracts** and references as they appear in the paper version will be on the World Wide Web.

Ferroelectrics Communications is distributed free to each paid subscriber to ***Ferroelectrics, Ferroelectrics Letters Section***, and ***Integrated Ferroelectrics***. It is also available for sale by subscription at a nominal cost.

For more information contact George W. Taylor, Princeton Resources, PO Box 211, Princeton, NJ 08542-0211, USA

ECAPD-3 PAPERS --continued from page 4

D. Brandt, A. Popov, and V.H. Schmidt

A piezoelectric generator for in-flight electrical powering and projectile guidance systems
D. Segal and I. Bransky

Practical applications of $LiNbO_3$ crystals doped with impurities Mg, Zn, In
T.R. Volk, M. Woehlecke, N.V. Razumovski, and N.M. Rubinina

Mathematical model and parameters of holograms recording process in photorefractive polymers
E.S. Kovalenko, S.N. Sharangovich, and T.E. Zelenskaya

Mirrorless oscillation in photorefractive crystals
G. Jäkel, E. Krätzig, J. Neumann, and S. Odoulov

Optical spatially distributed computer-based information system
S.O. Kramaarov and S.V. Sokolov

Photorefractive effects in inorganic and organic materials
G. Montemezzani, M. Zgonik, and P. Günter

Route to spatial solitons in photorefractive $KNbO_3$ crystals
R. Ryf, G. Montemezzani, M. Zgonik, and P. Günter

Optical bistability, regenerative pulsations, and self-assembly of spatial patterns in PMN
J.F. Scott and R.A. O'Sullivan

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ECAPD-3 PAPERS

Dynamic photovoltaic lenses in iron-doped optical waveguides on lithium niobate
V. Shandarov

Photorefractive response in sillenite crystals with shallow traps by applying an alternating electrical field
S.M. Shandarov, O.V. Kobozev, A.V. Reshetko, and M.G. Krause

Collinear interaction of orthogonally polarized leaky modes in $LiNbO_3$:Cu:Ti waveguides
Yu. Solomonov, S. Shandarov, and V. Shandarov

Investigation of self-focusing in SBN
D. Breitling and A. Siahmakoun

Torsion optical methods and gears to operate the optical radiation and to measusre the physical quantities
R. Vlokh, M. Kostyrko, and I. Skab

Optimal control of laser induced transient birefringence in liquid crystals
B.E. Vugmeister, J. Botina, and H. Rabitz

Electrooptic and Raman investigations of nonstoichiometric cromium doped lithium niobate crystals
K. Chah, M. Aillerie, P. Bourson, M.D. Fontana, and G. Malovichko

Nonlinear optical properties of hydrazone derivates
M.S. Wong, U. Meier, Ch. Bosshard, P. Feng, and P. Günter

Relaxation mechanisms in nonlinear optical polymers
P. Kaatz, P. Pretre, U. Meier, Ch. Bosshard, and P. Günter

Basic Research

Magnetic properties of impurity centers of three valence iron ions in colquiriites structure
R. Yu. Abdulsabirov, I.I. Antonova, S.L. Korableva, and V.G. Stepanov

The effect of the surface-pretilt on chevron structures
M. Ambrozic, S. Kralj, N. Vaipotic, and S. Zumer

Hyperfine interactions in $SrRuO_3$
P. de la Presa, A. Ayala, A. López-Garcia, J.A. Guevara, S.L. Cuffini, and Y.P. Mascarenhas

Application and radiospectroscopy methods for the studying of PLZT ceramics
I.P. Bykov, M.D. Glinchuk, V.V. Laguta, Yu.L. Maximenko, and L. Jastrabik

Li^7 NMR in $LiNbO_3$ crystals with different nonstoichiometry
E.V. Charnaya, V.S. Kaperovich, and S. Klimko

PAC investigation in $AHfO_3$ with A=Ca, Sr and Ba
P. de la Presa and A. López-Garcia

Dynamics of the switching process in homeotropic ferroelectric liquid crystal cells
I. Drevensek-Olenik and M. Copic

Physics of photorefractive polymers
S. Ducharme, M. Liphardt, A. Goonesekara, J.M. Takacs, and Zhang Lei

The dynamics of paramagnetic Ti^{2+} defects in K_2SeO_4 crystals
V.N. Efimov and G.V. Mamin

The EPR study of radiation induced hole centers in $KTiOPO_4$
V.N. Efimov, M.A. Laruhin, and V.A. Nazarova

Soft modes and phonon interactions in $Sn_2P_2Se_6$ and $Sn_2P_2S_6$ studied by inelastic neutron scattering
S.W.H. Eijit, R. Currat, J.E. Lorenzo, S. Katano, P. Saint-Gregoire, B. Hennion, and Yu.M. Vysochanskii

Molecular dynamics in NH_4Cr-alum in paraelectric phase
A.R. Fakhrutdinov, E.N. Frolova, and G.P. Vishevskaja

Raman selection rules and relaxor/ferroelectric behavior in PLZT compounds
M. El Marssi, R. Farhi, J.-C. Picot, and D. Viehland

Effects of nonstoichiometry on Raman spectra of $K_6Li_4Nb_{10}O_{30}$ (KLN) compounds
W. Fortin, G.E. Kugel, and D. Rytz

Low temperature EPR studies of mixed RADP and D-RADP crystals
V.V. Izotov, V.N. Efimov, and M.A. Laruhin

Acoustic dispersion of $(NH_3C_2H_5)_2MnCl_4$ near the structural phase transition at 226 K
A.V. Kityk, W. Schranz, A. Fuith,

ECAPD-3 PAPERS

V.P. Soprounyuk, and H. Warhanek

Relaxor-like behavior of pyrochlores
N.N. Kolpakova, M. Wiesner, G. Kugel, and P. Bourson

Influence of intrinsic defects concentration on light induced changes of photorefractivity in lithium niobate
S.M. Kostritzkii and O.G. Sevostyanov

The nematic ordering of a liquid crystal confined to the control porous glass
A. Zidansek, Z. Bradac, S. Kralj, G. Lahajnar, S. Zumer, and R. Blinc

Computer simulation of the pressing process
Yu.V. Dashko, S.O. Kramarov, L.M. Katsnelson, and A.N. Kovalenko

Low temperature properties of incommensurate ferroelectrics $(Pb_ySn_{1-y})_2P_2Se_6$ and their potential application as capacitance temperature sensors insensitive to high magnetic field
M.M. Major, S.A.J. Wiegers, Th. Rasing, S.W.H. Eijit, F.C. Penning, Yu.M. Vysochanskii, and H. van Klempen

Dynamic phenomena in ferroelectric semiconductors
R.F. Mamin, Yu.S. Greznev, and O.A. Salangina

Electric field influence on soliton structure $[N(CH_3)_4]_2ZnCl_4$ crystals in the presence of the viscous interaction
S.A. Sveleba, I.I. Polovinko, Yu.I. Pankivskyi, V.S. Zhmurko, and M.I. Bublyk

Articifial pyroelectricity and volumetric piezoeffect in GaAs-type crystals
Y.M. Poplavko and L.P. Pereverzeva

Collective excitations in electric dipole glasses
R.V. Saburova, I. Sh. Akmadullin, and S.A. Yumatov

Lattice dynamics of Cs_2HgCl_4 crystals
Ya.I. Shchur and O.G. Vlokh

Influence of defects on the elastic thermal and dielectric properties of ferroelectric crystals in the vicinity of phase transitions
A.U. Sheleg, O.B. Plyusch, and E.V. Shesholko

Theoretical model of self-conjugation at stimulated backscattering of "boiling"-speckle pump beam in photorefractive crystals
K. Kolchin and V. Shkunov

Manifestation of the long-period phases coexistence with incommensurate phase
S.A. Sveleba, I.I. Polovinko, and Yu.I. Pankivskyi

Phase transition and dielectric relaxation in $[N(C_2H_5)_4]_2MeCl_2Br_2$ (Me=Zn, Co) solid solutions
V. Kapustianik, S. Sveleba, R. Tchukvinskyi, Z. Czapla, and S. Dacko

Relaxor properties of lead iron tungstate ceramics
Zhou Liqin, P.M. Vilarinho, and J.L. Baptista

Stiffening and splitting of the soft mode of $KTaO_3$ induced by doping with Li
H. Vogt

Ferroelectric switching in SBN crystals with various impurities
T.R. Volk, V.V. Ivanov, V. Yu. Solabutin, and L.I. Ivleva

NMR spin-lattice relaxation study of $Cs_{1-x}(NH_4)_xH_2PO_4$
S.C. Meschia, A. Zidansek, D. Brandt, and V.H. Schmidt

Surface topography influence on the defect density in the SmC* devices
J. Pirs, S. Kralj, S. Pirs, and B. Marin

Part II of the ECAPD-3 papers will be published in the Winter 1997 issue.

For current information on
ISIF 97
see the
Web home page
http:\\www.sp.nps.navy.mil

ELECTROCERAMICS V PAPERS

Invited Papers

Atomistic computer modeling of electroceramic materials
C.R.A. Catlow

Chemical solution synthesis of $PbTiO_3$-$PbZrO_3$ compositions: Metastable phase selection and epitaxial films
Fred F. Lange, A.D. Polli, and C.G. Levi

PZT thin films for sensors and actuators
P. Muralt

Intelligent process models for better ceramic powders
E.A. Gulliver and R.E. Riman

Low-temperature synthesis of barium titanate based electroceramics by sol-gel processing
M. Kuwabara, H. Matsuda, H. Shimooka, S. Takahashi, and T. Miyabe

The use of mixed ionic electronic conductors in solid oxide fuel cells
L.J. Gauckler and M. Godickemeier

Electrical anisotropy and electronic conductivity of BIMEVOX electrolytes
J. Fouletier, C. Muller, and E. Pernot

Electrical properties and microstructure of magnetically textured composite $DyBa_2Cu_3O_{7-x}$ ceramics
M. Ausloos, N. Vandewalle, H. Bougrine, Ph. Vanderbemden, N. Mineur, and R. Cloots

Microwave high dielectric constant

CONFERENCE REPORT

ELECTROCERAMICS V

From 2 - 4 September 1996, **Electroceramics V** was held as an International Conference on Electronic Ceramics and Applications at the University of Aveiro, Portugal, under the auspices of the European Ceramic Society. The event was organized by Prof. J. L. Baptista and his group and attracted 228 participants from 26 countries. The scientific program comprised plenary sessions in the mornings in the City Auditorium located at a nicely renovated former ceramic factory. In the afternoons, up to seven parallel sessions were conducted in lecture halls at the University campus with contributed oral presentations of 12 minutes length and some keynote lectures. Simultaneously, 160 posters were presented.

The conference addressed advances in electronic ceramic materials, state of the art applications, and novel components, emphasizing developments since the last Electroceramics Conference in Aachen, Germany, two years ago. The sessions covered material classes such as pyroelectrics & piezoelectrics, ferroelectrics & relaxors, dielectrics, ionic & electronic conductors, superconductors & magnetics, as well as thin films, processing & microstructure development, and grain boundary phenomena.

One trend which emerged from the variety of scientific contributions was the rise in computer modeling and the application of numerical methods. A few examples shall be mentioned. C.R.A. Catlow presented convincing demonstrations of the increase in power and precision of structures and properties of ceramic materials in the areas of complex crystal structures, defect chemistry, and surface structure. In processing, the research group of R. E. Riman introduced a concept which quantitatively takes into account the local correlation of powder particles of different composition (quantified by a property he called "mixedness") as well as their particle size distributions. The model aids in the derivation of basic principles for optimizing powder beds in calcination processes and improving the reproducibility of ceramic synthesis techniques. This approach is complemented by a mocular modeling study of the sintering and grain growth processes presented by H. Matsubara and R. J. Brook with appealing video examples.

Another trend which already had become significant during **Electroceramics IV** is the aspect of mechanical properties, strength, fracture toughness, and reliability of electronic ceramics, especially for piezoelectric applications. Several talks were attributed to the mechanical properties of PZT ceramics, including the dependence on additives and the growth of indentation cracks. Finite element modeling is used in the area of the mechanical properties and the coupling to the electrical and thermal behavior of ferroelectric ceramics and components. The limitations of piezoelectric multilayer actuators under high dynamic large-signal operation conditions were shown to be caused primarily by design and joining techniques rather than by the piezoceramic material.

The trend towards the integration of electroceramic functionalities continues. While the integration of different ceramic materials (e.g., dielectric, magnetic, ion conducting) in monolithic multifunctional components

CONFERNCE REPORT

ELECTROCERAMICS V -- continued from page 8

and substrates was less pronounced than two years ago, the integration of electroceramic thin films with Si based devices was seen to be progressing rapidly. For example, Paul Muralt of EPFL, Lausanne, summarized work on PZT films which confirmed the recent hypotheses that polycrystalline PZT film orientation can be controlled, even on Si/SiO_2 substrates, by appropriate control of a TiO_2 interfacial layer. The process was applied to the manufacture of oriented PZT pyroelectric devices. The device integration reported that it had achieved good yields and is close to a manufactural process. Muralt also described good progress in the development of a PZT based thin film piezoelectric micromotor. Properties were compared to an earlier ZnO based device. Andreas Seifert (also EPFL) reported on the development of Ca substituted $PbTiO_3$ films aimed at achieving a high pyroelectric figure of merit.

Researchers at the University of Rome (Traversa and Gusmano) described the development of Li-doped amorphous TiO_2 films for use as humidity sensors. In this case the group was using a bulk rather than a surface effect, in which Li substitute ions moderate ionic transport of protons originating from a humid environment. The relative humidity can be determined from the strong dependence of resistance on the proton concentration.

Besides these recent trends, bridges were built between the knowledge on conventional bulk ceramics and new applications. As an example, Poplavko reviewed a wide range of high K microwave dielectrics. Materials were categorized by application area, and single crystals, ceramics, and thin film properties were described. Application categories included: 1) thermally stable, low loss dielectrics for microwave substrates, dielectric resonators, waveguides and antennae; 2) nonlinear dielectric films for phase shifters and tunable filters; and 3) microwave absorbent dielectric ceramics. Progress in each category was described, with particular emphasis on dielectric losses.

The conference was closed by a fabulous gala concert of the Lisbon Metropolitian Orchestra under the direction of Maestro Graca Moura, performing pieces of two Portuguese composers, Braga Santos and Pedro Osorio, and the 7th Symphony, op. 92, of Ludwig van Beethoven. This delightful concert certainly will remain in our hearts and minds--together with the friendly and helpful attitude of the people of Aveiro.

For the next conference, the Organizing Committee accepted an offer of Prof. N. Setter to hold it in Montreaux, Switzerland, in June 1998, together with the next International Symposium on Applications of Ferroelectrics (ISAF) and the next European Conference on Applied Polar Dielectrics (ECAPD). We anticipate a superior event, Nava!

Rainer Waser,
RWTH Aachen University of Technology, Germany

Angus I. Kingon,
North Carolina State University, USA

ELECTROCERAMICS V PAPERS --continued from page 8

ceramics
Y.M. Poplavko

Moving hot spot in ceramics
M. Takata, T. Okamoto, Y. Kurihara, and B. Huybrechts

Thin film gas sensors based on metal oxides
H. Meixner and M. Fleischer

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Fifteenth Conference on Crystal Growth and Epitaxy
1 - 4 June 1997
Stanford Sierra Camp, Fallen Leaf Lake, California

The conference objectives are to bring together a number of experts in the fields of crystal growth and epitaxy to discuss recent progress and achievements in fundamental and applied research and to consider new applications and commercial development oppportunities. The comfortable and informal atmosphere promotes interactions between participants and is expected to help integration of graduate students and young professionals, whose participation is encouraged, in the international crystal growth and epitaxy community.

Contributed talks and posters on experimental and theoretical aspects of crystal growth, epitaxy, and characterization are welcome. Awards will be presented for the best student papers.

Abstracts

Abstracts are due on 1 February 1997. Send single page camera-ready abstract including title, names and addresses of authors to the Program Chairperson:

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Influence of cooling rate on the electrical properties of ZnO based varistors containing 10 wt percent of $Zn_4CoCrMnSb_2O_{12}$ phase
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Vanadium dioxide based ceramics
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Application of low frequency impedance spectroscopy to medium voltage ZnO varistors
D. Binesti and J.M. Lebreton

The evaluation of ZnO grains parameters in zinc oxide ceramics
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Non-ohmic zinc oxide ceramics with lead oxide addition
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International Symposium on Ferroic Domains and Mesoscopic Structures (ISFD 4), Vienna, Austria	25-29 May 96	No.1, p.15
10th American Conference on Crystal Growth (ACCG-10) with 9th International Conference on Vapor Growth and Epitaxy (ICVGE-9), Vail, C olorado	4-9 Aug 96	No.1, p.15
3rd Pacific Rim Conference on Ferroelectric Applications, Coop-Inn, Kyoto, Japan	27-29 May 96	No.2, p.16
International Session of Ferroelectric Materials and Their Applications (FMA-13), Coop-Inn, Kyoto, Japan	29 May 96	No.2, p.16
Ferroelectrics and Their Applications, short course, Cranfield, England	23-28 Jun 96	No.2, p.16
1996 IEEE International Symposium on the Applications of Ferroelectrics (ISAF '96), East Brunswick, New Jersey	18-21 Aug 96	No.2, p.18
International Conference on Electronic Ceramics and Applications, Electroceramics V, Aveiro, Portugal	2-4 Sep 96	No.2, p.19
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9th International Meeting on Ferroelectricity (IMF-9), Seoul, Korea	24-29 Aug 97	No.3, p.10
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Dec 2-6	•	MRS 1996 Fall Meeting, Boston, Massachusetts. Information: Werner Lutze, University of New Mexico, phone (505) 277-7964, fax (505) 277-5433, e-mail brbl@unmb.unm.edu

1997

Mar 2-5	•	ISIF 97, Santa Fe, New Mexico, (see *Ferroelectricity Newsletter*, 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
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 p. 22)
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 24-29	•	9th International Meeting on Ferroelectricity (IMF-9), Seoul, Korea (see *Ferroelectricity Newsletter*, Vol. 4, No. 3, p. 10)

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