

ALCOM Update

NSF Science and Technology Center for Advanced Liquid Crystalline Optical Materials

Consortium of Kent, Case Western Reserve, and Akron

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JUNE 1997

Kent State University dedicates new Liquid Crystal Institute/Materials Science Building



Bill Doane, LCI Director Emeritus (right) cuts ribbon at the building dedication. Assisting Doane are (from left) John West, LCI Director, Ron Pizzuti, Chair, KSU Board of Trustees, and Carol Cartwright, President of Kent State University.

Kent State University formally dedicated its new Liquid Crystal Institute Materials Science Building at a ceremony on Friday, June 6, 1997. The \$13.6 million, three-story facility houses the Glenn H. Brown Liquid Crystal Institute, Chemical Physics Interdisciplinary Program, 3,500 sq. ft. liquid crystal display research facility clean room, three teaching laboratories, two classrooms, 25 individual research laboratories, conference rooms, and a 150-seat auditorium.

The Institute is also headquarters for ALCOM, the NSF Science and Technology Center for Advanced Liquid Crystalline Optical Materials, a consortium of Kent State University, Case Western Reserve University, and The University of Akron.

The building was open for tours during the morning, followed by the dedication ceremony at 11:00 a.m. Speakers included Ronald A. Pizzuti, Chair of KSU Board of Trustees, KSU President Carol A.

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Allan Kmetz speaks at LCI building dedication

Among the speakers for the dedication of the new Liquid Crystal Institute/Materials Science building on June 6 was Dr. Allan R. Kmetz from Lucent Technologies who spoke on the LCI's contributions to business and industry.

Lucent was a significant contributor to the new building, donating a \$2 million

display fabrication pilot line for the liquid crystal display research facility.

"Lucent has a special interest in Ohio--we have a lot of customers here and we employ more than 6,000 people here--but northeastern Ohio is especially important because of the unique contributions of

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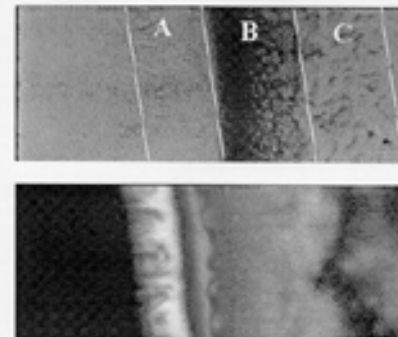
RESEARCH NOTES

Koenig's research recognized as outstanding new development in chemistry. The following is reprinted from *Analytical Chemistry News and Features*, February 1, 1997.

Diffusion studies using IR microspectroscopy

Because of its ability to obtain chemical information from areas as small as 10 μ m, IR microspectroscopy has been used to tackle problems in polymer science, forensic science, earth science, pharmaceuticals, and electronics. Jack L. Koenig and colleagues at Case Western Reserve University have used spatially resolved IR microspectroscopy to conduct in situ diffusion experiments of photocured polymer-dispersed liquid crystals. Studying the diffusion of liquid crystals into polymers is important because of the dependence of the phase-separation dynamics of these blends on diffusion parameters.

They measured the concentration profiles by monitoring the hydroxyl band of the monomer as a function of time and spatial position and calculated diffusion coefficients from least-squares fitting of the data. The diffusion of a low molecular weight liquid crystal into a photopolymerized monomer followed Fick's Second Law of Diffusion at a temperature above the critical temperature of



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ALCOM's Spring Activities

by John L. West

Spring has been full of activity. On April 15th we submitted the renewal proposal for ALCOM funding to the National Science Foundation. ALCOM Industrial Partners have received a copy of the proposal. I encourage and look forward to your comments and suggestions. Also on April 15th, Jack Koenig received the 1997 ACS Phillips Award in Applied Polymer Science at a symposium in his honor at the Spring ACS meeting in San Francisco. My personal congratulations and thanks to Jack. The honor is well deserved and adds to the prestige of ALCOM.

We put the final touches on and formally dedicated the new Liquid Crystal In-

stitute building on June 6th. The morning dedication was followed by a series of plenary lectures, including talks by George Gray, Atsuo Fukuda, and Alfred Saupe in honor of Bill Doane. We are very proud of the new building and hope you will come and see the facilities soon.

Throughout the spring we have been preparing for the on-site NSF review of ALCOM to be held June 25-27 at the new LCI building. At the site-visit we will highlight results of past ALCOM research and present our plans for the future. Representatives of the Ohio Board of Regents and the Ohio Department of Development will outline the considerable

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Cartwright, Allan R. Kmetz from Lucent Technologies, Ohio State Senator Leigh Herington, and Myron S. Henry, KSU Provost. Speakers from the LCI included Peter Palffy-Muhoray, Associate Director, Chad Hoke, doctoral student, and John West, Director.

In her speech, President Cartwright said that the university "now has a world-class facility" to go with its "world-class faculty and staff" in liquid crystal research. "This is much more than an academic housewarming," Cartwright said and added that "among our most ambitious goals is to help create the liquid crystal equivalent of California's Silicon Valley--a 'Crystal Corridor' in Ohio."

State Senator Leigh Herington of Kent, a KSU alumnus, praised the institute, its founders and the current staff for their contributions not only to Northeast Ohio but to the world.

John West, LCI Director, credited his predecessors with developing strong collaborative efforts with business and industry locally and nationwide that will help draw more interest in the Institute in the future. "This new building is the focus of research, education, and development and fosters collaboration across the campus, region, state, and world and demonstrates our commitment to research," West stated. "My vision is that in five to ten years we will see new industry and benefits."

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Phil Bos named as new LCI associate director

Professor Philip J. Bos was recently named associate director for applied programs at the Liquid Crystal Institute and director of the ALCOM Industrial Partnership Program. Bos assumed the position which was previously held by Dr. John L. West, who became LCI Director in January 1997.

Bos has been a senior research fellow at the LCI since 1994 and is currently an Associate Professor in the Chemical Physics Interdisciplinary Program. Prior to joining the Institute, Bos was a principal scientist at Tektronix, Inc., in Beaverton, Oregon, working on applications of liquid crystals in their Display Research Department.

"John West built the industrial partnership program and made it highly successful," Bos stated. "As a result of his efforts we will soon be opening our prototyping clean room which will greatly add to our ability to provide value to our industrial partners," Bos added.

Dr. Bos' work is widely published in the area of applications of liquid crystals and he holds several patents in the field. He is very interested in educational programs targeted at industrial scientists in the area of liquid crystals. Dr. Bos may be reached by phone: (330) 672-2511; fax: (330) 672-2796; or e-mail: pbos@kent.edu.

ALCOM

NSF Science and Technology Center
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Consortium of Kent, Case Western Reserve and Akron

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Associate Director - J.L. Koenig

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Plenary lectures held at Kent



Speakers Atsuo Fukuda, Alfred Saupe, Bill Doane, and George Gray

Four renowned liquid crystal scientists were guest speakers at the plenary lectures held in conjunction with building dedication ceremonies at Kent on June 6.

Professor George Gray gave an address on "Liquid Crystals -- Thoughts on Some Recent Developments." Dr. Gray, retired from the University of Hull, was instrumental in developing the materials which made the twisted nematic display popular and is responsible for designing novel synthetic routes for commercial materials.

Professor Atsuo Fukuda, a member of the Faculty of Textile Science and Technology at Shunshu University and currently President of the International Liquid Cryst-

tal Society, spoke on "Thresholdless Antiferroelectricity (TLAF) in Liquid Crystals and its Application to Displays."

Dr. Alfred Saupe, KSU Professor Emeritus, talked about "Surface Relief of Cholesteric Textures and Blue Phases." Professor Saupe's pioneering work has been widely published and presented by invitation at numerous international venues.

Dr. J. William Doane, recently retired as Professor of Physics and Director of the LCI, spoke on "The Making of a Technology." Professor Doane is one of the inventors of polymer dispersed liquid crystals. He was also instrumental in forming the International Liquid Crystal Society.

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the Kent State Liquid Crystal Institute," Kmetz stated in his speech.

"Both academically and commercially, the cornerstone of the liquid crystal world was laid in Kent, Ohio. The Liquid Crystal Institute has continued ever since to support interdisciplinary education and research on liquid crystals, to develop technology and to stimulate the formation of business enterprises to use it," added Kmetz.

Lucent made the decision to concentrate on their core business of telecommunications and turned away from thoughts of LCD manufacturing. "We determined that the best use of the equipment would be to donate it to the preeminent academic cen-

ter for liquid crystal research in the country," Kmetz said. "Today that equipment is available here in the Kent State University Liquid Crystal Institute for the benefit of all of US industry."



Dr. Allan Kmetz from Lucent Technologies speaks on LCI's contributions to business and industry

RESEARCH NOTES, from page 1

the mixture. Optical micrographs of the system after diffusion and polymerization showed three distinct regions: a nematic liquid crystal molecularly mixed cross-linked network of the polymer, a nematic liquid crystal droplet gradient in the polymer matrix, and polymer fibers scattered in the continuous nematic liquid crystal. Research is underway to understand the morphological behavior and to determine the limits of solubility of the liquid crystal in the cured matrix using an IR microspectrometer. (*Appl. Spectrosc.* 1996, **50**, 1339-44).

PUBLICATIONS

"Pretransitional Nematic Ordering in Liquid Crystals with Dispersed Polymer Networks," Y.K. Fung, A. Borstnik, S. Zumer, D.-K. Yang and J.W. Doane, *Phys. Rev. E* **55**, 1637-1645 (1997).

"Wavelength Selection in Slowly Quenched Systems," P. Palffy-Muhoray, W. E. Mol. *Cryst. Liq. Cryst.* **292**, 345 (1997).

"Models of Non-Newtonian Hele-Shaw Flow," L. Kondic, P. Palffy-Muhoray, M.J. Shelley, *Phys. Rev. E* **54**, R4536 (1996).

"Freedericksz Transition Measurements on Polymer-Stabilized Liquid Crystals," S. Mora, A.M. Jamieson, L.C. Chien, *Mol. Cryst. Liq. Cryst.* **292**, 323-331 (1997).

"Surface Phase Transitions in Nematic Liquid Crystals with Planar Anchoring," R. Seidin, R.M. Hornreich, D.W. Allender, *Phys. Rev. E* **55**, 4302-4313 (1997).

SPRING ACTIVITIES, continued from page 2

support the State provides for the Center. We hope the site-visit results in continued strong NSF support for ALCOM. We are poised for continued success and growth.

After an active and productive spring we anticipate an even better summer. The new clean room will come on line in August and we will all be able to focus completely on the research that is the heart of ALCOM.

Clean room facility construction on schedule *by Bahman Taheri and Doug Bryant*

Construction of the new LCI cleanroom is progressing according to schedule. The Class 100 room devoted to the manufacturing pilot line is nearing completion. The Fujioka plate aligner, Nissha Angstromer offset printer, and Fujioka rubbing machine donated by Lucent Technologies have been placed in the completed portions of the class 100 and 1000 areas.

Privacy windows based on PDLC technology have been installed to separate these areas from the main corridor. These windows allow visitors to observe the cleanroom operation and can provide privacy when needed for our industrial partners using the equipment.

Due to size restrictions, several of the largest pieces of equipment were craned into the space during the two weeks prior to the LCI's building dedication. An opening for the rigging was created by removing window panels from the corner of the building.



Above: Kevin Liticker, clean room laboratory technician, works on setting up the Lucent display fabrication line.

Left: A crane places a large piece of equipment into the third floor clean room area.

The craned equipment includes some of the Lucent Technologies donation, a Nakan offset printer, Kawajiri thermal press, and a custom vacuum deposition system for thermal evaporation of high pretilt silicon monoxide films. The installation of this equipment is currently in progress. The remainder of the process equipment will be installed upon completion of the cleanroom, scheduled for August 20.



Far left: Privacy windows allow visitors to observe operations.

Left: The windows also give privacy when needed.

DEDICATION *from page 2*

West closed the dedication speeches with a thought toward the future when he said, "people will point to this building and say it started here and ask 'I wonder what they are working on in there now.'"

Mrs. Jessie Brown, widow of Glenn Brown, and her daughter, Barbara were in attendance to witness the dedication of the new building to house the Liquid Crystal Institute, founded by Dr. Brown in 1965.

Dr. J. William Doane, Director Emeri-

tus of the LCI, cut the ribbon officially opening the building with the assistance of John West, Ron Pizzuti, and Carol Cartwright.

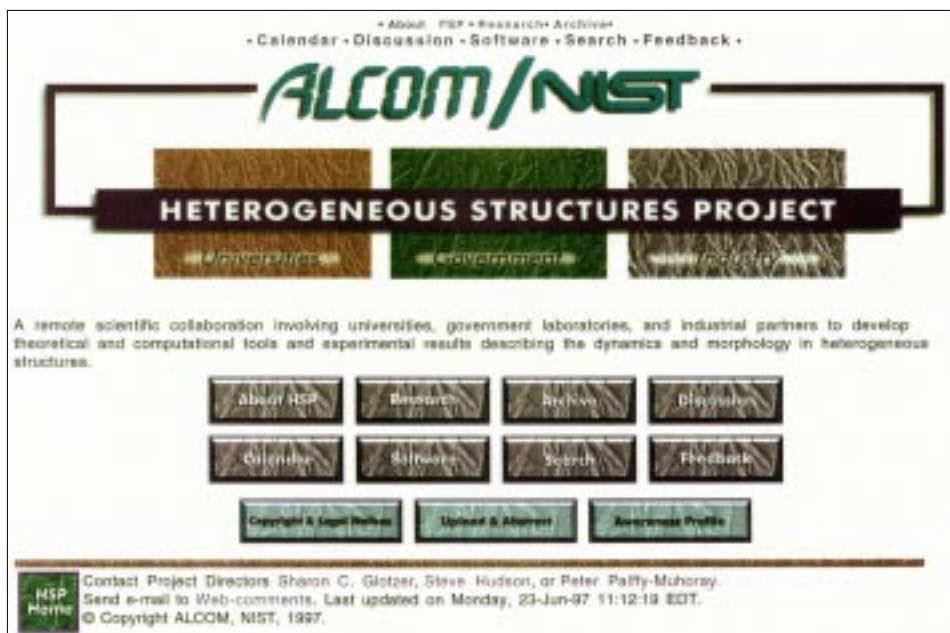
To exemplify the research at the Institute, a "high-tech" ribbon cutting ceremony followed the traditional ribbon cutting. A "laser ribbon" was cut using a liquid crystal switchable window to block the laser beam. The technology for the switchable window was patented by Kent State University in 1983 and is currently being manu-

factured by 3M and Marvin Windows.

During the dedication luncheon, Mr. Pizzuti and President Cartwright presented a glass etching of the new building to Dr. and Mrs. Doane in recognition of Doane's significant contributions to the Institute. Etchings were also presented to Lucent Technologies, Dai Nippon Printing, W.M. Keck Foundation, and Samsung Electronics, in appreciation of their generous donations to the new building.

Heterogeneous structures project and information management

by Laura Bartolo and Peter Palfy-Muhoray



Home page of the web site for the heterogeneous structures project

Information management has emerged as an area of great importance in ALCOM research. At the national level, the Digital Libraries Initiatives (NSF, DARPA, NASA) and the National Information Infrastructure (NIST) have defined the foundation for robust electronic scientific repositories where multimedia objects -- data, formal and informal literature, and images -- can be stored, searched, and retrieved within indexed collections.

At the state level, Ohio's plan of action, "Competing on Knowledge," aims to establish information networks linking universities, government, and industry.

Within the Heterogeneous Structures project a Web-server has been constructed to facilitate remote scientific collaboration among the project participants including other universities (UCLA, NYU), government laboratories (NIST, WPAFB), and industrial partners (General Motors, IBM, dpiX, Raychem).

The work will generate an indexed repository of theoretical and computational tools and experimental results describing the dynamics and morphology of heterogeneous structures. In addition, the pilot project has begun to systematically investigate the generation, storage, flow and use of scientific information by researchers in a

networked environment.

With support from ALCOM/NIST/KSU and the assistance of two graduate students from KSU's School of Library and Information Science, the project database collects, indexes, abstracts and updates project information such as preprints, published papers, and scientific presentations. Project participants contribute original research to the database through web-based submitting forms. The automated current awareness program alerts researchers about new information via email based upon personalized research profiles.

A cross-disciplinary, domain-specific vocabulary for liquid crystal and phase separation research is also being developed. As part of its development, the information management system may be extended to other projects in ALCOM. Presentations on the information management component of the Heterogeneous Structures Project have been given at the International WebNET '96 Conference (October, 1996) and the 8th Conference of the Association of College and Research Libraries (April, 1997).

Website: cpip.kent.edu/PSP (password protected). For more information or a password, contact Laura M. Bartolo (lbartolo@kent.edu) or Peter Palfy-Muhoray (mpalfy@cpip.kent.edu).

Undergraduates participate in summer research

ALCOM encourages participation of undergraduates in summer research experience. Research projects usually are incorporated in publications. The list below identifies students in the 1997 program and their ALCOM supervisors.

Kate Allender

Dr. L.-C. Chien

Emma Birath

Dr. P. Palfy-Muhoray

Randal Boettner

Dr. O. D. Lavrentovich

Lauren Borkowski

Dr. L.-C. Chien

Jason Chonko

Dr. P.J. Bos

Aaron Cooley

Dr. O. D. Lavrentovich

Eliezer Gurarie

Dr. C. Rosenblatt

Burt Heldreth

Dr. L.-C. Chien

Erica Humeniuk

Dr. M.E. Neubert

Eric Jones

Dr. J.L. Koenig

Mark Lohman

Dr. M.E. Neubert

Genevieve Mathieson

Dr. W. Gordon

Travis Ribar

Dr. J.L. Koenig

Christopher Rodd

Dr. J.L. Koenig

Michael Smith

Dr. M.E. Neubert

Stella Souers

Dr. L.-C. Chien

Daniel Thompson

Dr. D. Schuele

William Wang

Dr. W. Gordon

Computational Liquid Crystals Seminar *by Chuck Gartland*

This coming fall, we will be resurrecting (after a long rest) the interdisciplinary "Computational Liquid Crystals" seminar at Kent State University. We will be meeting weekly or biweekly (depending on the level of interest) to discuss problems and research on liquid crystal systems and their numerical modeling. We encourage the participation of faculty, post-docs, and grad students with interests in these topics. If interested contact Chuck Gartland, Dept. of Math/CS, Kent State University. Tel: (330) 672-4004 x362; gartland@mcs.kent.edu.

Campbell is Finalist for Research Award

Sandi G. Campbell was selected as a finalist for the 1997 Waldo Semon Undergraduate Research Award in Polymer Science and Polymer Engineering. The award symposium was held at the University of Akron, April 18, 1997. As a finalist, Sandi presented a lecture on "Photochemical Modification of a Cholesteric Side-Chain Copolysiloxane."

Sandi graduated from Kent State University with a B.S. in Chemistry, December, 1996; she is currently a Chemistry Technician at the Liquid Crystal Institute.

1997 International Display Research Conference

in association with the Society for Information Display (SID)
Sept. 15-19, 1997

Toronto, Ontario, Canada

This international conference only comes to North America every three years and is usually on the west coast. With Toronto so close to Ohio, this is a great opportunity to attend. For details on the conference, contact Dr. Philip J. Bos, Liquid Crystal Institute, Kent State University, Kent, OH 44242-0001; Tel: (330) 672-2511; Fax: (330) 672-2796; e-mail: pbos@kent.edu.

Web Sites

ALCOM Home Page

<http://alcom.kent.edu/ALCOM/ALCOM.html>

Liquid Crystal Institute, KSU

<http://www.lci.kent.edu>

Dept. Macromolecular Science, CWRU

<http://k2.scl.cwrw.edu/cse/emacs/>

Department of Physics, CWRU

<http://cwsing.phys.cwrw.edu/phys/physdept.html>

Polymer Science, University of Akron

<http://www.polymer.uakron.edu/>

On-Line Polymer Liquid Crystal Tutorial

<http://abalone.cwrw.edu>

Experiment at a Distance

<http://scorpio.kent.edu/ALCOM/eo.html>

Optics of Cholesteric Liquid Crystals

<http://alcom.kent.edu/~tik/choles.html>

ALCOM Education Home Page

<http://olbers.kent.edu/alcomed/k12.html>