

ASSOCIATES OF THE ELECTRONIC DESIGN CENTER

Dr. Harihara Baskaran

Department of Chemical Engineering
Email: hxb35@case.edu Phone: 216-368-1029

Dr. Baskaran's research is on transport phenomena in biology and medicine. He focuses on microvascular tissue engineering and cell/cellular transport processes in inflammation, wound healing, and cancer metastasis. Dr. Baskaran uses soft lithography techniques at the EDC to build PDMS and collagen microfluidic structures.

Dr. Harold Kahn

Department of Material Science and Engineering
Email: hkx29@case.edu Phone: 216-368-6384

The EDC works closely with the DMSE. The need for visual, chemical and mechanical data on the novel films and devices make it a necessity to work closely with material scientists who have the tools available and the knowledge necessary to consult on material processing in microfabrication. The EDC is extremely fortunate to be near the Swagelok Center for Surface Analysis of Materials (SCSAM) at Case Western Reserve University (CWRU). SCSAM is a multi-user, analytical facility providing instrumentation for microstructural characterization of materials, as well as surface and near-surface chemical analysis. DMSE also possess a nanoindenter which is vital in determining the hardness of deposited films. Dr. Kahn's research is focused on materials for microelectromechanical systems (MEMS), wafer-level mechanical testing of microfabricated inorganic specimens and nanostructured biological specimens and shape-memory actuated microfluidic devices.

Dr. Heidi Martin

Department of Chemical Engineering
Email: hbm@case.edu Phone: 216-368-3810

Dr. Martin's research focuses on engineering materials for biomedical and biochemical applications. She is currently developing conductive, diamond-based electrodes for implantable electrochemical devices. Her group is the campus source for conductive or non-conductive diamond films. They are working with the EDC on development of flexible diamond electrodes.

Dr. David Schwam

Department of Material Science and Engineering
Email: David.Schwam@cwru.edu Phone: 216-368-6499

Dr. Schwam's research involves, among other topics, laser applications in materials processing. With his help, the EDC has been able to add a new fabrication method to its repertoire, laser ablation. The computer controlled NdYAG laser can precisely ablate thin metal films from substrates such as Al₂O₃ and AlN. The laser can also be used to create shadow masks for microfabrication out of thin metal sheeting.

Dr. Jesse Wainright

Department of Chemical Engineering
Email: jsw7@case.edu Phone: 216-368-5382

Integrated Micro Fuel Cell / Silicon CMOS Technology
In collaboration with Georgia Institute of Technology, this program developed technology necessary to co-fabricate PEM fuel cells with microelectronic circuits on silicon. New polymer electrolytes were developed for vapor feed direct methanol fuel cells as part of this effort in conjunction with Prof. M. Litt of the Macromolecular Science Department.

Low-Cost Modular Fuel Cell:

In this DOE funded effort, thick film printed components such as current collectors, gaskets and 2D microfluidic channels are being coupled with injection molded plastic housings to create an extremely light-weight and low cost fuel cell stack. Endura Plastics of Kirtland OH is a partner on this project.

CORPORATE COLLABORATORS

The Electronics Design Center carries out joint research and development projects, technical assessment, prototype fabrication, and technology transfer. The Center has the infrastructure, technical staff, and facilities to undertake these collaborative efforts. The Center interacted with more than seventy companies in the last two years alone. The following companies have recently worked with the EDC:

AGI Technologies (CDM) – Seattle, WA
Battelle, Pacific Northwest National Laboratory – Richland, WA
BIOMEC, Inc. – Cleveland, OH
Bliley Technologies, Inc. – Erie, PA
Brims Ness Corp. – South Portland, ME
Cleveland Medical Devices – Cleveland, OH
Dolphin System – Chesterton, IN
Dow AgroSciences – Indianapolis, IN
Emerson Electric Co. – St. Louis, MO
Eveready Battery Co. – Westlake, OH
Faraday Technology, Inc. – Dayton, OH
Ford Motor Co. – Dearborn, MI
General Electric – Niskayuna, NY
Giner, Inc. – Newton, MA
Gould Electronics, Inc. – Willoughby, OH
Hays Cleveland – Cleveland, OH
Honda Research Institute USA, Inc. – Columbus, OH
L3 Communications – Mason, OH
Lubrizol – Wickliffe, OH
Makel Engineering, Inc. – Chico, CA
Microfabrication Solutions, Inc. – Cleveland, OH
Midwest Refineries – Waterford, MI
Morgan Electro Ceramics, Inc. – Bedford, OH
Motorola – Mesa, AZ
NASA Glenn Research Center – Cleveland, OH
NASA Jet Propulsion Laboratory – Pasadena, CA
NexTech – Columbus, OH
Nipro Medical, Inc. – Osaka, Japan
Ohio Fuel Cell Coalition – Cleveland, OH
Perkin Elmer, BioInstrument Group – Lexington, MA
Polygenesis Corp. – Monmouth Junction, NJ
Proctor & Gamble – Cincinnati, OH
Promerus LLC – Brecksville, OH
Raytheon Integrated Defense – Andover, MA
Rockwell-Automation – Cleveland, OH
Rosemount Analytical, Inc. – Orrville, OH
R.W. Beckett Corp. – Elyria, OH
Sensor Development Corp. – Rocky River, OH
Stratum Energy Systems LLC – Cleveland, OH
STERIS, Inc. – Mentor, OH
Theken Disc – Akron, OH
Toho Technology Corp. – Chicago, IL
Wright Fuel Cell Group (CWRU) – Cleveland, OH



CASE

CASE WESTERN RESERVE UNIVERSITY



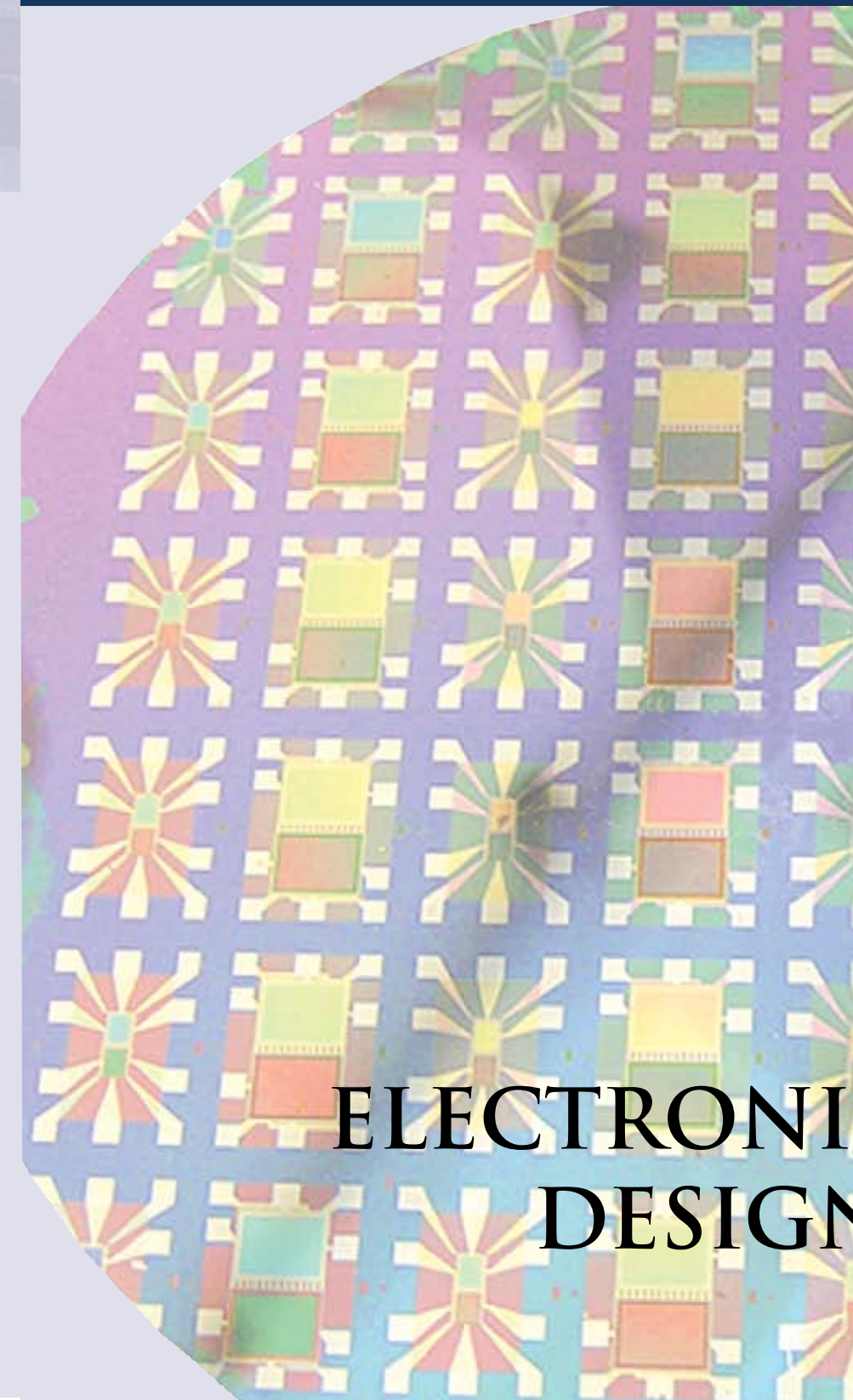
CASE

CASE WESTERN RESERVE UNIVERSITY

Electronics Design Center

10900 Euclid Avenue
Bingham Building, Room 107A
Cleveland, OH 44106-7200

www.engineering.case.edu/edc

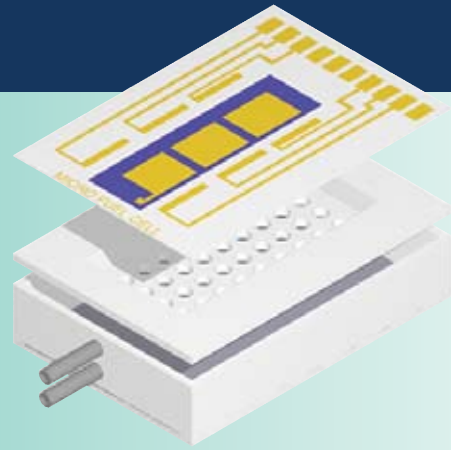


- ▼ Providing innovative and novel uses of microfabrication processing
- ▼ Specializing in microfabricated sensors (chemical, biological, physical)
- ▼ Experts in microfabricated fuel cells and thick film batteries
- ▼ Providing full-time engineers dedicated to solving design problems and producing prototypes
- ▼ Specializing in wireless telemetry, electronics and ASIC design
- ▼ Offering prototype foundry service, facility access, product development and collaborative research

ELECTRONICS DESIGN CENTER

Microfabricated solid-oxide electrolyte oxygen sensor array

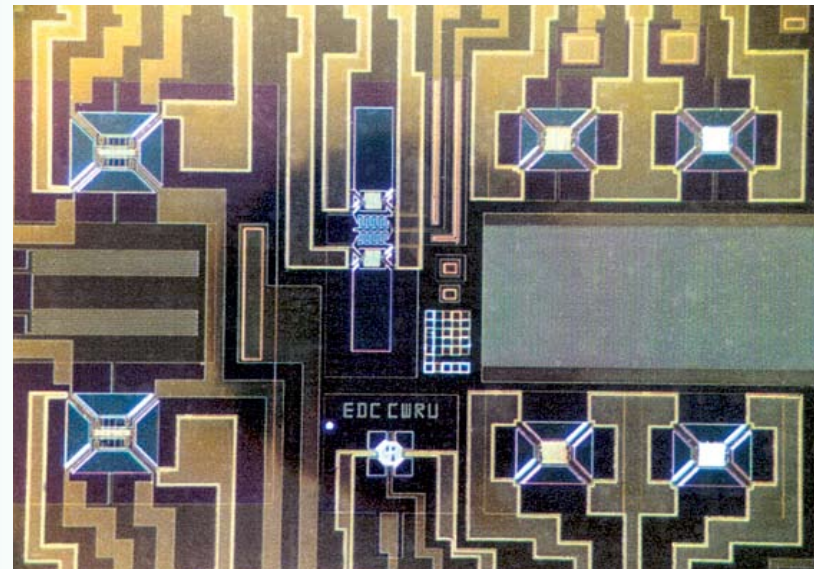
THE MISSION OF THE EDC



Hydrogen powered micro fuel cell

The mission of the Electronics Design Center (EDC) is to advance the science and technology of microsensors and microsystems for chemical and biological applications and to provide education, training, expertise and facilities for students, faculty and industrial researchers to advance these technologies. The EDC has pursued research in areas ranging from hydraulic control devices, implant electronics, solid-state chemical sensors and biomedical sensors to micro-electrochemical energy systems, such as fuel cells and batteries and wireless multi-channel telemetry microsystems. Applications for this research include medical, biological, automotive, industrial process control and various environmental monitoring uses.

The EDC is not only an educational and research center but also a fully equipped microfabrication laboratory that provides services such as metal sputtering and evaporation, wafer dicing, wire bonding, and thick film printing. We have three clean rooms for processing, a Class 1000 room for thin film deposition, a class 10,000 room for thick film printing and a class 10,000 room with Class 10 laminar flow hoods for photolithography. One of our unique strengths is applying microfabrication processes to non-silicon, non-traditional materials. We specialize in small, prototyping runs of devices or can provide a service on a device that you already possess. The EDC has a full time staff to provide expertise in microfabrication, packaging and electronics.



Combined gas sensor platform

OUR FACILITIES AND CAPABILITIES INCLUDE:

RCA and Piranha Cleaning Stations

High Temperature Furnace Stack

Solid source boron and solid source phosphorous diffusion, wet and dry oxidation, annealing

Contact Aligner for Photolithography

2mm resolution; front-to-backside (IR) alignment

Photoplotter

3 micron mask resolution

Wet Etching Stations

Isotropic: SiO₂, Al, Au, Cr, glass Anisotropic: Si

DC Sputtering, e-beam Evaporation Tools

Ag, Al, Al₂O₃, Au, Be, BN, C, Cr, Fe, Ir, ITO, Ni, Pd, Pt, Rh, SiC, SiO₂, W, ZrO₂ and more

Thick-film Printing Tools

Inkjet for enzymes, proteins, silicones, nafion, solders, epoxies
Silkscreening for Au, Ag, Pt, Pd, C, glass and more

Dicing, Wire Bonding, Prototype Packaging Tools

ASIC, Analog, and Digital Circuit Design

FEATURED EQUIPMENT

Laurell computer-controlled spinner
Weneco programmable hot plate
Wafer Spin Rinse Dryers
Annealing Furnace
Denton Vacuum Discovery 18 for metal sputtering
Denton Vacuum Explorer 14 for insulator sputtering
DekTak 3 ST Surface Contact Profileometer
Non-contact Laser Profileometer for measuring thick films
MPM TF-100 Thick film printer
Nordson Asymtek Century Dispense Jet
Kulicke & Soffa Model 4123 wedge bonder
Micro Dicing Saw Model 1100
(maximum substrate thickness 0.635 mm)

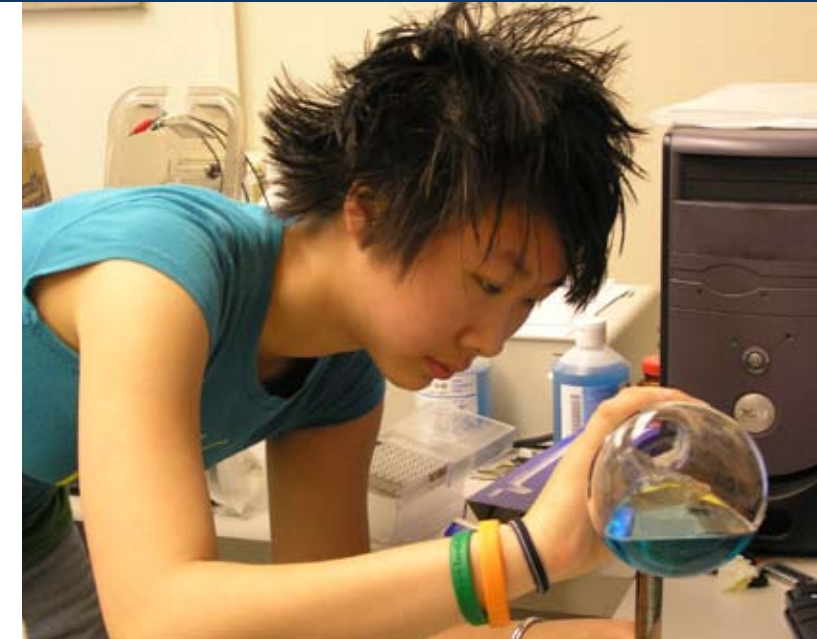


Dr. Chung-Chiun Liu

Wallace R. Persons Professor of Sensor Technology and Control
Professor of Chemical Engineering, Chemical Engineering Dept.
Director, Electronics Design Center

Professor Liu's research interest is in the areas of electrochemical engineering, microelectronic materials and fabrication processes. He works in the areas of electrochemical and biomedical sensors, micro-fabrication and micro-machining techniques to develop unique miniature electrochemical and biomedical sensors. He is also involved in the chemical engineering aspects of these processes and electronic packaging.

- Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring (PAESMEM), White House, March 2003
- Fellow, Electrochemical Society, May 1997
- Fellow, American Institute of Medical and Biological Engineers, March 1995
- Honorary Professorship, National Chiao Tung University, Taiwan, June 2005
- Recipient, Gold Medal, International Meeting on Chemical Sensors, July 1994, Rome, Italy
- Member, U.S. Delegate, International Coordinating Committee on Solid State Sensors & Actuators Research, 1989 to present
- Member, Steering Committee, International Committee on Chemical Sensors, 1990 to present



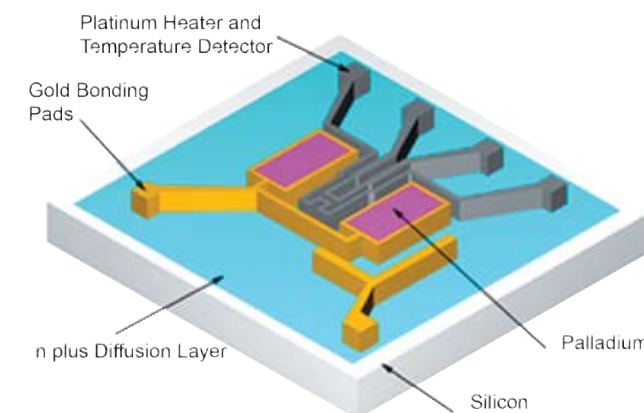
THE EDC MENTORING PROGRAM

The EDC mentors underrepresented minority and female high school students from the Greater Cleveland area to expose them to cutting edge technological activities. Dr. Liu was a recipient of a NSF Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring (PAESMEM) for the time period of March 2003 to March 2006. The goal of this award was to encourage and mentor young women and minorities to choose science and engineering in their college studies and professional career. Each year, we mentor an average of four young women from high schools ranging from ninth to twelfth grades for independent research projects

These students won major science competition awards including: three past finalist and two semifinalists in the 57th Intel Science and Engineering Fair in 2006 and one semifinalist in Intel Science Talent Search in 2007. One finalist and five semifinalists in the Siemens-Westinghouse Science & Technology Competition. Numerous regional and national science awards have been won by these students. Two students have been inducted into the National Gallery for Young Inventors Hall of Fame. In the last four years, two U.S. patents were issued based on the research of the students. Each student was listed as the first inventor in each patent, and the patents are:

A. (Ann) Lai, L.A Dudik and C.C. Liu "Method for detecting or monitoring sulfur dioxide with an electrochemical sensor"
U.S. Patent No. 6,623,620 September 23, 2003

B. (Bonnie) Curry, M.J. Shao, L.A Dudik and C.C. Liu "Method for detecting the amount of chlorine and bromine in water"
U.S. Patent No. 6,740,225 May 25, 2004



Schottky diode hydrogen sensor