

# Oliver Chyan

## Professor, Department of Chemistry, University of North Texas

Lead of the *Interfacial Electrochemistry and Materials Research laboratory (IEMR)*,  
University of North Texas, Denton, TX, 76203; Email: chyan@unt.edu, Phone: 940-565-3463

## Professional experience

2006-date	<b>Professor</b>	University of North Texas, Denton, Texas
2010	<b>Visiting Professor</b>	National Taiwan University, Taipei, Taiwan
2003-2004	<b>Visiting Associate Research Fellow</b>	Institute of Atomic and Molecular Sciences, Taiwan Academia Sinica, Taipei, Taiwan
2002-2014	<b>Associate Faculty</b>	Materials Science & Engineering Dept., UNT
1998-2006	<b>Associate Professor</b>	University of North Texas, Denton, Texas
1992-1998	<b>Assistant Professor</b>	University of North Texas, Denton, Texas
1990-1992	<b>Postdoctoral Researcher</b>	University of Cincinnati, Ohio
1984-1989	<b>Graduate Research Assistant</b>	Massachusetts Institute of Technology

## Education

1989	<b>Ph.D. in Chemistry, Massachusetts Institute of Technology, Cambridge, USA</b> Dissertation: “ <i>Electrochemical Characterization of Conducting Polymers and Fabrication of Microelectrochemical Transistor with Sub-micron Spacing</i> ”. Advisor: Professor Mark S Wrighton
1984	<b>M.S. in Chemistry, University of Texas at Arlington, Texas, USA</b> Thesis: “ <i>Electrochemistry and Photoelectrochemistry at Sn-doped Indium Oxide/Aqueous Electrolyte Interface</i> ”. Advisor: Professor Krishnan Rajeshwar
1982	<b>M.S. in Analytical Chemistry, National Taiwan University, Taipei, Taiwan</b> Thesis: “ <i>Determination of P, Ge and Si Species by Reductive Molybdate Colorimetry using Flow Injection Analysis</i> ”. Advisor: Professor Yin Mou Chen
1980	<b>B.S. in Chemistry, National Chung-Hsing University, Taichung, Taiwan</b>

## Awards

2019	<b>UNT College of Science Faculty Award for Research</b>
2000-2004	<b>Certificates of Honor Teacher for meritorious work with science students</b>
1994, 1997	<b>named in the Siemens Westinghouse Science &amp; Technology Competition</b>
1998	<b>University of North Texas Developing Scholar Award</b>

## Research Interests

Microelectronic Materials Chemistry, Interfacial Chemistry Design, Advanced IC Packaging, Microelectronic Fabrication and Process Integration, Nano Scale Materials Characterization, Microscopic Corrosion and Prevention, Molecular Electronics, Silicon Wafer Surface Chemistry, Electrocatalysts.

## Recent Research & Student Training Focus: Microelectronic Materials Chemistry

- Over 30 years of research expertise in material chemistry and interfacial characterization related to microelectronics fabrication, advanced packaging and process integration.
- Strong partnership with major IC companies: Intel, TSMC, GlobalFoundries, TI, TEL, NXP/Freescale, Lam Research, Cirrus Logics, K&S, MediaTek, ATMI/Entegris, JSR Micro, SCREEN, Mindox Techno, and L-3 Communications.
- Specialized in Interfacial Engineering across whole spectrum of IC fabrication processes: Front End of Line, Middle End of line, Back End of Line and IC Packaging.
- Develop patented novel patented wafer characterization technology employed by major microelectronic companies.
- Mentor outstanding Graduate Student researchers: *Thirty-two (>85% employed by microelectronic company)*

## Current Research Grants

1. **NXP Semiconductors:** “*Optimization of Corrosion Prevention Treatments for Cu Wire-Bonded Devices to Achieve High Bonding Reliability*”; 2020-2026; \$574,400 (as sole PI)
2. **NSF:** “*STTR Phase I: Ultra-low-cost Additive Manufacture of Transparent Conductive Electrodes*”; 2023-2025; \$285,000 (as Co-PI, Yieu Chyan (PI))
3. **Semiconductor Research Corporation:** “*Tunable Biobased Molding Compounds and Die-Attach Adhesives*”; 2023-2025; \$285,000 (as Co-PI, Nandika D’Souza (PI))
4. **Semiconductor Research Corporation:** “*Exploring Deep Eutectic Solvents as Environmentally Benign Post-etch Residue Removers*”; 2024-2026; \$315,000 (as Co-PI, Hao Yan (PI))
5. **Semiconductor Research Corporation:** “*Interaction Mechanisms of 2D Materials with FEOL Wet Cleans*”; 2024-2027; \$315,000 (as Co-PI, Wonbong Choi (PI))
6. **Kulicke & Soffa (K&S):** “*Explore UNT Passivation Coating on K&S Wafer Samples*” 2025-2026; \$3,733. (as sole PI)
7. **Cirrus Logic :** “*Apply UNT Passivation Coating on Cirrus Logic wafer Samples for Cu-Cu Wirebonding*” 2025-2026; \$5,940. (as sole PI)

## Research Accomplishments

Professor Chyan’s research program has an international reputation for successfully exploring critical underlying fundamental science to facilitate microelectronic fabrication technologies and functional nanostructure design development. Since 1992, Chyan established *the Interfacial Electrochemistry and Materials Research Laboratory* where he leads an interdisciplinary research team, *with strong collaboration with IC industry*, to investigate multitude of

fundamental and applied research projects relevant to advanced microelectronic fabrication and integration, IC packaging, semiconductor materials chemistry and interfacial electrochemistry. Select achievements are highlighted below.

## 1) Advanced Microelectronic Fabrication and Integration

### a) Advanced IC Packaging

#### (Focused on Fabrication of Next Generation High Density Cu Interconnect and Wire Bonding Reliability)

- Completed pilot production trial with Mindox Techno in Singapore and NXP at Malaysia based on UNT's Cu-selective passivation coating technology to improve wire bonding reliability. **(Mindox Techno, NXP)**
- Invent a Cu-selective passivation coating technology to achieve reliable Copper to Copper thermocompression Bonding with low cost. **(Elektrum Technologies)**
- Invent a Flux-less Cu pillar to solder bonding technology for Flip-chip packaging application **(SRC, TI, Intel )**
- Demonstrated Cu-Cu wedge bonding on Cu lead frame in open air enabled by Cu-selective passivation coating. **(NXP)**
- Demonstrated Cu-Cu ball bonding in open air assisted by Cu-selective passivation coating. **(NXP)**
- Explored a better understanding of fundamental corrosion mechanism of Cu wire bonded Al bond pad to aid the practical packaging process designs for improved reliability. **(NXP, Freescale, TI , SRC)**
- Invented a Cu selective CVD passivation treatment to enhance Cu wire bonded device reliability reaching *ppb* level failure rate. **(NXP, TI, SRC)**
- Identified key Chemical equilibria that enable precise control on the Cu etching rate to achieve high density interconnects fabrication in advanced IC packaging application. **(Intel, SRC)**
- Invention an attenuated total reflection ATR UV-Vis spectroscopic probe, *U.S. Patent 11099131*, 2021, to monitor and control Cu etching process for high-density Cu Interconnect fabrication. **(Intel, SRC)**
- Invented an electromagnetic radiation induced anisotropic Cu etching process, US patent pending, for high-density Cu interconnect fabrication. **(Intel, SRC)**
- Invented a novel phosphonic acid passivation coating for copper and aluminum to enhance IC packaging reliability. *U.S. Provisional Patent 63/886,578*, 2025.

### b) Front End of Line Processing for Microelectronic Fabrication

#### (Focused on Surface Preparation for Advanced Transistor Fabrication)

- Invented FEOL etchants that selectively remove growth defects from MOCVD 2D MoS<sub>2</sub> wafer to facilitate < 2nm transistor fabrication. **(TEL, Intel and SRC)**
- Explore wet chemistry processing mechanisms of 2-D materials for < 2nm transistor node application. **(TEL, Intel and SRC)**
- Established contamination mechanisms of trace inorganic and organic contamination on silicon wafer surfaces in SC1, SC2, BOE, HF wet cleaning processes. **(TI)**

- Invented Si-based Potentiometric Metallic Impurities sensor (U.S. Patent # 6145372) to aid FEOL chemical processing control in SC1, SC2, BOE, HF etching and cleaning. **(TI)**
- Invented Chemical Bonding Mapping Metrology to establish early back-bonded oxide formation on silicon wafer caused by ppb-ppt level of metallic contamination. **(TI, SRC)**
- Identified ppb organic contamination sources in HF by Multiple Internal Reflection Infrared Spectroscopy. **(TI)**

**c) Middle end and Back End of Line Processing for Microelectronic Fabrication  
(Focused on Nano-Interconnects and Porous Low-k Dielectric Optimization)**

- Explore wet/dry etches and cleans mechanism at the extreme confined spaces (1-5nm). **(TEL)**
- Explore interfacial chemistry optimization to achieve nano-interconnects (<15 nm) fabrication using Ru, Mo, Co and selected intermetallic materials. **(SRC)**
- Invented Ru-based liner/diffusion barrier (U.S. Patent # 7247554) that is directly Cu plate-able for advanced Cu interconnect application. **(TI, SRC)**
- Identified/solved fluoride-induced microscopic corrosion disabling defects in fabrication of TI's DLP dynamic mirror structure. **(TI)**
- Developed a rapid corrosion screening metrology relevant to advanced Cu interconnect fabrication processing, identify new corrosion inhibitors tailored to each chemical cleaning formulation. **(SRC, Intel, ATMI)**
- **Achieved UNT's largest-ever tech transfer award via licensing of MIR-IR wafer characterization metrology to Intel.**
- Applied MIR-IR metrology to monitor/optimize flowable Low-K manufacturing process/ **(Intel)**
- Developed a highly sensitive MIR-IR infrared spectroscopic metrology (U.S. Patent # 9366601) to aid RIE-patterned ultra-low k nanostructure with minimum dielectric damages. **(Intel, SRC)**
- Established chemical bonding structure of ultrathin (<1-2 nm) post-etch fluorocarbon polymer residue on low-k nano-drench structure. **(Intel, SRC)**
- Designed a UV-assisted removal mechanism and invented an effective cleaning process to remove hydrophobic post-etch residue to minimize low-k dielectric damages. **(Intel, TEL)**
- Optimized PECVD growth of  $\alpha$ -Si:H microbolometer sensor with PI's patented MIR-IR metrology for maximizing night vision camera performance. **(Army, L-3)**

## **2) Semiconductor Materials Chemistry**

- Exploring deep eutectic solvents as environmentally benign post-etch residue removers for IC fabrication.
- Mechanistic and kinetic investigation of hydrogen termination/passivation process on Si(100) and Si(111) wafer surfaces.
- Study of surface morphological transformation induced by trace metal ions deposition on Si and Ge wafer surfaces.

- Developed new environmentally friendly wet cleaning chemistry to achieve ultra-clean silicon wafer surface preparation.
- Invented a novel method to spontaneously deposit metal nanoparticles (such as Ag, Cu, Au, Pd and Pt) on polycrystalline diamond surfaces and identified its detailed deposition mechanism.
- Discovered metal nanoparticle/diamond composite system exhibited significant enhancement of electrocatalytic properties toward hydrogen evolution and formaldehyde oxidation.
- Deposited ultra-fine Pt and RuO<sub>2</sub> nanoparticles on arrayed carbon nanotubes as electrode materials for micro direct methanol fuel cells and supercapacitors applications.

### 3) Interfacial Electrochemistry

- Electrochemical investigation of the energetics of the semiconductor/solution interface during trace metal deposition led to a discovery of a silicon-based chemical sensor (US patent 6,145,372) for detecting trace metal ion impurities at ppb-ppt levels in ultra-pure IC chemicals.
- Identified strong interfacial bonding between underpotential deposited Cu monolayer and Ru metal that achieved interfacial stability even after annealed over 600 °C
- First to demonstrate that conductive ruthenium oxide surface also exhibits strong interfacial binding between Cu and RuO<sub>x</sub>, manifested by the Cu underpotential deposition process observed experimentally.
- Utilized RBS analysis to corroborate with TEM imaging to show that 5 nm Ru can function as a directly plate-able Cu diffusion barrier for Cu interconnects up to 300 °C anneal.
- High-resolution TEM revealed a ~2nm amorphous interlayer Ru<sub>2</sub>Si<sub>3</sub> growth at the Ru/Si interface played a key role of blocking the Cu inter-diffusion process.
- Identified, *for the first time*, microscopic hydrogen evolution was the main cathodic process to drive Cu wire bonding corrosion defects, induced by trace chloride ions.
- Established halides (Cl<sup>-</sup>, F<sup>-</sup>, Br<sup>-</sup>) induced Al corrosion mechanisms under Cu/Al bimetallic contact. Applied the new mechanistic insights to demonstrate a novel CVD passivation coating that provided highly effective corrosion inhibition protection.

### Graduate Students Training and Employments

The active collaboration between UNT and IC industry collaborators offers highly marketable education/research training to students. PI's Students often received high-tech job offers before they graduated. So far, 85% of 21 Ph.D and 11 M.S. graduated from PI's group enjoyed successful employment in IC-related industry.

Dinesh Kumaravel	Ph.D. (2026, expected)	Micron Technology
John Alptekin	Ph.D. (2023)	TI
Ashish Salunke	Ph.D. (2022)	Micron
Joshua Caperton	Ph.D. (2022)	Intel

Goutham Issac Ashok Kumar	Ph.D. (2021)	Intel
Muthappan Asokan	Ph.D. (2019)	Intel
Nick Ross	Ph.D. (2016)	Intel
Arindom Goswami	Ph.D. (2015)	Intel
Simon Koskey	Ph.D. (2014)	Intel
Oscar Ojeda	M.S. (2005)	Intel
Sarah Flores	M.S. (2006)	Intel
Kyle Kai-Hung Yu	Ph.D. (2011)	TEL
Karthik Pillai	Ph.D. (2011)	TEL
Trace Q. Hurd	Ph.D. (2005)	TEL
Raymond Chan	Ph.D. (2003)	TEL
Tamal Mukherjee	Ph.D. (2015)	Lam Research Inc.
Praveen Nalla	Ph.D. (2006)	Lam Research Inc.
Tana Arunagiri	Ph.D. (2003)	Lam Research Inc.
Thomas Ponnuswamy	Ph.D. (2002)	Lam Research Inc.
Yibin Zhang	Ph.D. (2005)	Intel
Sirish Rimal	Ph.D. (2015)	IBM
Shyam Venkataraman	M.S. (2007)	BASF – Electronics
Min Liu	M.S. (1995)	Steag HamaTech USA
Fei Xu	M.S. (1997)	Steag HamaTech USA
JunJun Wu	M.S. (1996)	Lucent
Steve Chien	M.S. (1994)	Conexant
Vivian Liang	B. S. (2001)	Motorola

### Research Grants: List of External Funding

PI has acquired over \$6.6 million external grant support into UNT. Total external awards are over \$8 million as PI, co-PI from various sources and Senior Investigators for NSF REU programs. Furthermore, PI received uninterrupted funding (2007-current) from the prestigious *Semiconductor Research Corporation* with active members from all major microelectronic companies including Intel, TEL, TI, NXP, MediaTek, AMD, GlobalFoundries, K&S, Cirrus Logic etc.

#### 1) Externally Funded and Pending Grants Application

Dates	Projects	Funding	PI/ co-PI	Funding Agency
2020-2026	Optimization of Corrosion Prevention Treatments for Cu Wire- Bonded Devices to Achieve High Bonding Reliability	\$557,400	PI	NPX Semiconductors
2024-2027	Interaction Mechanisms of 2D Materials with FEOL Wet Cleans	\$315,000	Co-PI	Semiconductor Research Corporation
2025-2026	STTR Phase I: Ultra-low-cost Additive Manufacture of Transparent Conductive Electrodes	\$305,000	Co-PI	NSF

2025-2026	Explore UNT Passivation Coating on K&S Wafer Samples	\$3,733	PI	K&S
2025-2026	Apply UNT Passivation Coating on Cirrus Logic wafer Samples for Cu-Cu Wirebondin	\$5,940	PI	Cirrus Logic
2024-2026	Exploring Deep Eutectic Solvents as Environmentally Benign Post-etch Residue Removers	\$315,000	Co-PI	Semiconductor Research Corporation
2023-2025	Tunable Biobased Molding Compounds and Die-Attach Adhesives	\$285,000	Co-PI	Semiconductor Research Corporation
2022-2024	Tunable Low-cost Passivation Coating for Facilitating Copper Wafer-level Bonding	\$289,547	PI	Semiconductor Research Corporation
2018-2021	Intel Technology Transfer Agreement on Acquiring UNT Patented Technology (US Patent # 9366601)	\$690,847	PI	Intel
2018-2020	Novel Chemical Approaches to Enhance Copper Etch Anisotropy for Advanced IC Packaging	\$176,000	PI	Intel, Semiconductor Research Corporation
2019-2020	Optimization of Cu-Selective Repassivation Treatments on Cu Redistribution Lines to Achieve Enhanced Reliability	\$88,850	PI	Texas Instruments
2018-2020	REC Inc. Licensed Agreement on UNT Patented IC Packaging Corrosion Prevention Technology	\$220,000	PI	REC Inc.
2017-2018	Protection of Aluminum Oxide and Cobalt Microstructures in Ammonium Fluoride Solution	\$75,000	PI	JSR-Micro
2016-2017	Characterization of Plasma Processed Patterned Wafers by MIR-IR Spectroscopy	\$21,420	PI	Intel
2016-2017	Characterization of Chemical Equilibriums of Cu Etch Bath Samples	\$7,200	PI	Intel
2015-2017	Mechanistic Investigation and Prevention of Al Bond Pad Corrosion in Cu Wire Bonded Device Assembly	\$163,333	PI	Semiconductor Research Corporation
2015-2016	Characterization of Plasma Processed Patterned Wafers by MIR-IR Spectroscopy	\$12,500	PI	Lam Research Inc.
2015-2016	Explore UV treatments for TTCA integrated wafer BEOL polymer removal using MIR-IR Spectroscopy	\$60,000	PI	TEL
2015-2016	Characterization of UV-radiated Post-etch Residue MIR-IR Spectroscopy	\$60,000	PI	TEL

2015-2016	Characterization of Carbon Nanotubes Coating on Wafers using MIR-IR Spectroscopy	\$3,000	PI	Nantero Company
2014-2015	Study of Plasma Processed Patterned Wafers by MIR-IR Spectroscopy	\$14,193	PI	Intel
2012-2014	Optimize Chemical Bonding Structure of PECVD Amorphous Silicon Micobolometer	\$ 10,000	PI	L3 Communication
2014-2015	Investigation of Al Pad Corrosion in the Cu Wire Bonded Semiconductor Device Assembly	\$85,000	PI	Semiconductor Research Corporation
2012-2013	Study of Chemical Bonding Structure of PECVD Amorphous Silicon Micobolometer	\$45,000	PI	Army
2012-2013	Study of Chemical Bonding Structure of PECVD Amorphous Silicon Micobolometer	\$35,000	PI	L3 Communication
2012-2014	Characterization of Plasma-etch-polymers using MIR-IR Spectroscopy	\$252,000	PI	Intel, Semiconductor Research Corporation
2012-2013	Evaluation of ULK Dielectrics Damages by MIR-IR Spectroscopy	\$6,000	PI	TEL
2012-2013	Characterization of Plasma-etched SiC wafers by MIR-IR Spectroscopy	\$6,000	PI	Lam Research Inc.
2011-2012	Characterization of Plasma-Etch-Polymers Using MIR-IR Spectroscopy	\$135,000	PI	Semiconductor Research Corporation
2012-2013	Plasma-etched ULK Patterned wafers Studied by MIR-IR Spectroscopy	\$15,000	PI	ATMI
2011-2012	Characterization of Cu/W/Co Bimetallic Corrosion and Inhibition IC Cleaning Solution Environments	\$48,000	PI	ATMI
2010-2012	Interfacial Study of Cu Bimetallic Corrosion and Inhibition IC Cleaning Solution Environments	\$123,000	PI	ATMI
2010-2012	Hybrid Nanocomposite High-k Dielectric Flexible Films for Semiconductor Applications	\$196,461	PI + 2 co-PIs	Norman Hackerman Advanced Research Program
2010-2012	Electrochemical Investigation of Cu Corrosion in Cu-CMP and Post-CMP Solution Environments	\$150,000	PI	Semiconductor Research Corporation
2007-2008	Study of Organometallic Chemistry and Its Applications to ALD TaN Barrier	\$ 40,000	PI +1 co-PI	Lam Research Inc.
2008-2010	Electrochemical Investigation of Cu Corrosion in Cu-CMP and Post-CMP Solution Environments	\$100,000	PI	Semiconductor Research Corporation

2007-2010	Investigation of Cu Electrodeposition and Patination on Metallic Oxide	\$150,000	PI	Robert A. Welch Foundation
2006-2007	Study of Semiconductor Surface Chemistry and Its Applications to Advanced Interconnects	\$ 40,000	PI	Lam Research Inc.
2004-2007	Corrosion Investigation in a Dynamic Environments for the Next Generation Cu Interconnect Microstructure	\$30,000	PI	Semiconductor Research Corporation
2004-2007	Interfacial Study of Metal Deposition on Metallic Oxide Surfaces	\$150,000	PI	Robert A. Welch Foundation
2004-2007	Bimetallic Corrosion at the Dissimilar Interfaces with Nanometer Dimension	\$150,000	PI	Semiconductor Research Corporation
2002-2004	Developing a new Ruthenium-based Diffusion Barrier for Copper Interconnects	\$264,890	PI + 1 co-PI	Texas Advanced Technology Program
2002-2003	Wet Chemical Cleaning Processes	\$105,337	PI	Texas Instruments
2001-2004	Metal Deposition on Early Group 14 Elements: Diamond, Silicon and Germanium	\$150,000	PI	Robert A. Welch Foundation
2000-2001	Trace Silver Detection in Natural Waters Using Silicon-based Sensor and Ion Exchange Membrane	\$ 20,000	PI	Eastman Kodak
1998-1999	Investigate the Cleaning Conditions for the Cooper Metallization in ULSI Applications	\$24,000	PI	Texas Instruments
1998-2001	Investigation of Discrete Metal Deposition on Semiconductor Surfaces	\$126,000	PI	Robert A. Welch Foundation
1998-1999	Trace Silver Detection in Natural Waters Using Silicon-based Sensor and Matrix Isolation Technique	\$50,000	PI	Eastman Kodak
1996-1998	Scanning Probe Microscopic Studies of Metal Depositions on Dissimilar Metallic Surfaces	\$103,200	PI	Robert A. Welch Foundation
1995-1998	Silicon-based Sensor Assembly for Trace Silver Detection	\$80,000	PI	Eastman Kodak
1997-1998	Detecting Trace Level Organic Contaminations In Microelectronic Processing Chemicals Using ATR-FTIR Techniques	\$5,000	PI	SAMATECH
1996-1997	Characterization of Trace Organics Adsorbed on Silicon Surface by Multiple Internal Reflection FTIR	\$22,000	PI	Texas Instruments

1995-1996	Sensor for Ultra -Trace Level Detection of Metallic Ions in Hydrofluoric Solutions	\$45,000	PI	Texas Instruments
1994-1995	AFM Morphological Studies of Conducting Polymer Films	\$12,500	PI	Gumbs Associates, Inc
1994-1995	High Surface Area Electrode Materials for Advanced Battery and Fuel Cell Applications	\$22,500	PI	Gumbs Associates, Inc
1994-1997	AFM, STM and Electrochemical Characterization of Silicon Surfaces	\$49,000	PI	Texas Instruments
1993-1995	Interfacial Characterization on HF/Silicon Wafer Systems	\$85,959	PI	Texas Instruments

## 2) Realized Value of Intellectual Property from the PI's IEMR Laboratory

Patented Technology	Funding	Funding Sources	Tech Transfers
#9366601 (2016) <i>MIR-IR Wafer Characterization Technology</i>	\$2,094 K	Intel, SRC, TEL, Lam, TI	Intel ( <i>Signed</i> , \$840K) Bruker, Entegris ( <i>in negotiation</i> )
#62/511863 (2017) <i>CVD Corrosion Inhibition Treatment</i>	\$3,165 K	SRC, NXP, TI, REC, K&S	REC Microelectronics ( <i>Signed</i> , >\$220K)
#11099131 (2021) <i>Light Induced Anisotropic Cu Etching</i>	\$183 K	Intel	Intel, CHEMCUT Inc. ( <i>In negotiation</i> )
#7247554 (2007) <i>Ru-based Cu Diffusion Barrier</i>	\$415 K	Intel, TI, SRC, ATMI,	-
#6145372 (2000) <i>Silicon based Chemical Sensor</i>	\$659 K	TI, SRC, Kodak	-
<b>TOTAL</b>	<b>&gt;\$ 6.5 millions</b>		

### 3) Participate as a Senior Investigator in Highly Successful NSF REU Programs (2001-2021)

<b>Dates</b>	<b>REU Projects</b>	<b>Funding</b>	<b>Supporting role</b>	<b>Funding Agency</b>
2001-2004	REU Site for Electronic Materials PI: Angela Wilson	\$264,494	Senior Investigator	National Science Foundation
2003-2006	Research Experience for undergraduates in chemistry at UNT PI: Angela Wilson	\$161,061	Senior Investigator	National Science Foundation
2007-2010	Undergraduate research opportunities in chemistry at UNT PI: Angela Wilson	\$219,447	Senior Investigator	National Science Foundation
2010-2014	Research Experience for undergraduates in chemistry at UNT PI: Angela Wilson	\$214,551	Senior Investigator	National Science Foundation
2015-2018	REU Site : Opportunities in chemistry at the Interface of Computation and Experiment at UNT PI: LeGrande Slaughter	\$243,742	Senior Investigator	National Science Foundation
2019-2021	REU Site : Opportunities in chemistry under Team Mentors Guidance at UNT PI: LeGrande Slaughter	\$259,852	Senior Investigator	National Science Foundation

## Publication (Reviewed Articles, Proceeding, Patents and Invention Disclosures)

**Summary: Invention and Technology Transfer:** Professor Chyan has filed 31 patent disclosures to UNT Research office. Four United States Patents (*US Patent#* 6145372, 7247554, 9366601 and 11099131) were awarded to professor Chyan's inventions. In addition, six US Provisional Patent #62/432115, #62/511863, #62/897942, #18/674,810, 63/727,186 and 63/886,578 were filed by UNT based on Professor Chyan's inventions.

### 1) Patent Related Publications

1. "Sensor for Monitoring of Ultra-trace Metallic Contaminations in Microelectronic Processing Chemicals," Chyan, O.M.R.; *UNT Invention Disclosure*, February 9, 1995.
2. "An On-line Potentiometric Sensor for Trace Metal Detection in Semiconductor Processing Chemicals", Chyan, O.M.R.; Hall, L; Sees, J; *TI Invention/Innovation Disclosure*, July 9, 1996.
3. "An Apparatus and Method for Detecting Impurities in Wet Chemicals", Chyan, O.M.R.; Hall, L; Sees, J; *UNT Invention Disclosure*, April 30, 1997.
4. "An Apparatus and Method for Detecting Impurities in Wet Chemicals" Hall, L; Sees, J; Chyan, O.M.R.; *US Patent*, 6,145,372, 2000.
5. "New Cu-diffusion Barrier Materials Based on Ruthenium, Iridium and Its Oxides," Ponnuswamy, T.; and Chyan, O.M.R.; *UNT Invention Disclosure*, October 26, 2001.
6. "Method of Using Materials Based on Ruthenium and Iridium and Their Oxides, As a Cu Diffusion Barrier, and Integrated Circuits Incorporating Same" Chyan, O.M.R. and Ponnuswamy, T.; *UNT Invention Disclosure*, July, 2003.
7. "Method of Making Integrated Circuits Using Ruthenium and Its Oxides as Cu Diffusion Barrier", Ponnuswamy, T.; Chyan, O.M.R. *U.S. Patent No. 7247554*, 2007.
8. "Method of Infrared Detection for Plasma Reactive Ion Etching and Post Etch Cleans ", Chen, J. J.; Chyan, O.M.R. *UNT Invention Disclosure*, 2011.
9. "Wafer Fabrication Monitoring/Control System and Method" Chen, J.J.; Chyan, O.M.R.; *United State Provisional Patent Application*, 61/465,154, 2011, 145 pages.
10. "Wafer Fabrication Monitoring/Control System and Method" Chen, J.J.; Chyan, O.M.R.; *UNT Invention Disclosure*, 2012.
11. "Method of Corrosion Inhibition in Semiconductor Device Assembly" Chyan, O.M.R.; Ross, N.; *UNT Invention Disclosure*, 2016.
12. "Cupric Chloride Etch Rate Monitoring System" Lambert, A; Chyan, O.M.R., *UNT Invention Disclosure*, 2016.
13. "Wafer Fabrication Monitoring/Control System and Method" Chen, J.J.; Chyan, O.M.R.; *U.S. Patent* 9366601, 2016.
14. "Systems and Methods for Copper Etch Rate Monitoring and Control", Lambert, A.; Chyan, O.M.R.; *U.S. Provisional Patent* 62432115, 2016.

15. "Mechanistic Investigation and Prevention of Al Bonded Pad Corrosion in Cu Wire-bonded Device Assembly", Ross, N.; Chyan, O.M.R.; *U.S. Provisional Patent 62511863*, 2017.
16. "Method of Cu Etching for High Density Interconnects", Chyan, O.M.R.; *UNT Invention Disclosure*, 2018.
17. "Method of Control Wet Etching of Aluminum Oxide", Ashok Kumar, G. I.; Chyan, O.M.R.; *UNT Invention Disclosure*, 2018.
18. "Selective One-step Corrosion prevention treatment for Copper via Chemical Vapor deposition", Asokan, M.; Chyan, O.M.R.; *UNT Invention Disclosure*, 2018.
19. " Wafer Fabrication Monitoring/Control System Based on Infrared Spectroscopy", Chen, J.J.; Chyan, O.M.R.; *UNT Invention Disclosure*, 2019.
20. "Ambient Control Anisotropic Cu Etching", Caperton, J.; Chyan, O.M.R.; *UNT Invention Disclosure*, 2019.
21. "UV Light Induced Anisotropic Cu Etching for High Density Interconnect", Caperton, J.; Chyan, O.M.R.; *UNT Invention Disclosure*, 2019.
22. "Selective Surface Finishing for Corrosion Inhibition via Chemical Vapor Deposition", Asokan, M.; Chyan, O.M.R.; *U.S. Provisional Patent 62897942*, 2019.
23. "Systems and Methods for Copper Etch Rate Monitoring and Control", Lambert, A.; Chyan, O.M.R.; *U.S. Patent 11099131*, 2021.
24. "Passivation Coating on Copper Metal Surface for Copper Wire Bonding Application", Alptekin, J.F.; Ashok Kumar, G. I.; Chyan, O.M.R.; *UNT Invention Disclosure*, 2021.
25. "Selective Surface Finishing for Corrosion Inhibition via Chemical Vapor Deposition", Asokan, M.; Chyan, O.M.R.; *United States Patent Application, US 2021/0071308*, 2021.
26. "Passivation Coating on Copper Metal Surface for Copper Wire Bonding Application", Chyan, O.M.R.; Alptekin, J.F.; Ashok Kumar, G. I., *United States Patent Application, UNTP.P0037US.P1/1001200335*, 2022
27. "Cu-Selective Passivation Coating for Copper Pillar Solder Bonding Application", Antony Jesu Durai, K.; Salunke, A. S.; Kumaravel, D. K. ; Chyan, O.M.R.; *UNT Invention Disclosure*, 2023.
28. "Tunable Low-cost Passivation Coating for Facilitating Flux-less Bonding of Copper Solder Interconnects in Flip Chip Assembly", Antony Jesu Durai, K.; Salunke, A. S.; Kumaravel, D. K. ; Chyan, O.M.R.; *United States Patent Application, US Patent Application 18/674,810*, 2024.
29. " Tunable Low-cost Passivation Coating for Facilitating Copper-to-Copper Bonding in Interconnect Fabrication", Antony Jesu Durai, K.; Kumaravel, D. K. ; Chyan, O.M.R.; *U.S. Provisional Patent 63/727,186*, 2024.
30. " Phosphonic Acid Passivation of Copper and Aluminum for Enhanced Reliability", Dinesh Kumaravel; Shinoj Nair; Chyan, O.M.R.; *U.S. Provisional Patent 63/886,578*, 2025.

31. "Semi-Aqueous Cleaning Compositions and Methods for MoS<sub>2</sub> Thin Films in Electronic Devices", Choi, W.; Shinoj Sridharan, S.; Chyan, O.M.R.; *UNT Invention Disclosure*, 2026

**Summary: Publications and Professional Presentation:** Professor Chyan has published 106 papers in peer-reviewed journals and conference proceedings. Professor Chyan has given more than 250 scientific lectures (including 107 invited talks) during his tenure at UNT.

## 2) Selected Publications

1. "Heterojunction Photoelectrodes II. Electrochemistry at Tin-doped Indium Oxide /Aqueous Electrolyte Interfaces", Chyan, O. M. R.; Rajeshwar, K. *J. Electrochem. Soc.*, 1985, *132*, 2109.
2. "Heterojunction Photoelectrodes III. Cyclic Voltammetry at Indium Tin Oxide-coated Silicon / Aqueous Redox Electrolyte Interfaces", Chyan, O. M. R.; Ho, S. I.; Rajeshwar, K. *J. Electrochem. Soc.*, 1986, *133*, 531.
3. "Quantitation of Lens Protein Mixed Disulfides by Ion-Exchange Chromatography", Lou, M. F.; Mckellar, R.; Chyan, O. M. R. *Exp. Eye Res.*, 1986, *42*, 607.
4. "New Conducting Polymers of Some Bithiophene- and Bis-N-Methylpyrrole Polyenes, Their Properties and Their Application in Microelectrochemical Devices", Baeuerle, P.; Wrighton, M. S.; Chyan, O. M. R.; Spangler C. W. *Ber. Bunsenges. Phys. Chem.*, 1987, *91*, 889.
5. "Chemically Modified Microelectrode Arrays: New Kinds of Electronic Devices", Wrighton, M. S.; Chao, S.; Chyan, O. M. R.; Jones, E. T.T.; Lofton, E. P.; Schloh, M. O.; Shu, C. F., in *Chemically Modified Surface in Science and Industry*, D. E. Leyden, W. T. Collins, ed., Gordon and Breach Science Publishes, N.Y., 1988, P. 337.
6. "Preparation and Characterization of Molecule-Based Transistors with a 50 Nanometer source-Drain Separation Using Shadow Deposition Techniques: Toward Faster, More Sensitive Molecule-Based Devices", Jones, E. T. T.; Chyan, O. M. R.; Wrighton, M. S. *J. Am. Chem. Soc.*, 1987, *109*, 5526-5528.
7. "Potential Dependence of the Relative Conductivity of Poly (3-Methylthiophene): Electrochemical Reduction in Acetonitrile and Liquid Ammonia", Crooks, R. M.; Chyan, O. M. R.; Wrighton, M. S. *Chem. Mater.*, 1989, *1(1)*, 2.
8. "Imaging Surface Atomic Structure by Means of Auger Electrons", Hubbard, A. T.; Frank, D. G.; Chyan, O. M. R.; Golden, T. *J. Vac. Sci. Tech.*, 1990, *B8*, 1329.
9. "Imaging Surface Atomic Layers by Means of Auger Electrons", Batina, N.; Chyan, O. M. R.; Frank, D. G.; Golden, T.; Hubbard, A. T. *Naturwissenschaften*, 1990, *77*, 557.

10. "Direct Imaging of Monolayer and Surface Atomic Structure by Angular Distribution Auger Microscopy", Frank, D. G.; Golden, T.; Chyan, O. M. R.; Hubbard, A. T. *J. Vac. Sci. Tech.*, 1991, *A9*, 1254.
11. "Direct Imaging of Thin Film Atomic Structure by Angular Distribution Auger Microscopy", Frank, D. G.; Golden, T.; Chyan, O. M. R.; Hubbard, A. T. *Appl. Surf. Sci.*, 1991, *48-49*, 166.
12. "Imaging Monolayer Structure by Means of Auger Electrons", Frank, D. G.; Chyan, O.M.R.; Golden, T.; Hubbard, A. T. *J. Vac. Sci. Tech.*, 1992, *A10*, 158.
13. "Probing Three Distinct Iodine Monolayer Structures at Pt(111) by Means of Angular Distribution Auger Microscopy: Results Agree with Scanning Tunneling Microscopy", Frank, D. G.; Chyan, O. M. R.; Golden, T.; Hubbard, A. T. *J. Phys. Chem.*, 1993, *97*, 3829.
14. "Auger Electron Angular Distributions from Al(100): Resolution of an Apparent Contradiction" Chyan, O. M. R.; Frank, D. G.; Doyle, C.A.; Hubbard, A. T. *J. Vac. Sci. Tech.*, 1993, *A11*, 2659.
15. "Auger Emission Angular Distributions from a Silver Monolayer in the presence and Absence of an Iodine Overlayer: Evidence for the Predominance of Inhomogeneous Inelastic Scattering of Auger Electrons by Atoms", Frank, D. G.; Chyan, O. M. R.; Golden, T.; Hubbard, A. T. *J. Phys. Chem.*, 1994, *98*, 1895.
16. "Measurement of Complete Auger Electron Emission Angular Distribution from SiC Films on Si(100)" Chyan, O. M. R.; Frank, D. G.; Hubbard, A. T.; Li, J.P.; Steckl, A.T. *J. Vac. Sci. Tech. B*, 1994, *B12*, 457.
17. "Auger Emission Angular Distributions from Pt(111): the Effect of Adsorbed Iodine Monolayer", Doyle, Charles A.; Chyan, O. M. R.; Frank, D. G.; Golden, T.; Hubbard, A. T. *Surface and Interface Analysis*, 1994, *21(2)*, 123.
18. "Kinetics and Morphology of Copper Deposition on Hydrogen -Passivated Silicon Surfaces from Dilute HF Solutions", Sees, J.; Hall, L.; Chyan, O. M. R.; Chen, J.J.; Chien, H.Y., Proceedings of the Second International Symposium on Ultra-clean Silicon Surfaces, Brugge, Belgium, 1994, p 147.
19. "Electrochemical Aspects of Noble Metals Related to Silicon Wafer Cleaning", Chyan, O. M. R.; Chen, J.J.; Chien, H.Y.; Hall, L.; Sees, J., Proceedings of the Second International Symposium on Ultra-clean Silicon Surfaces, Brugge, Belgium, 1994, p 213.
20. "High Surface Electrode Materials by Direct Metallization of Porous Substrates", Chyan, O. M. R.; Chen, J.J.; Liu, M.; Richmond, M.G.; Yang, K.; MRS Proceedings of Materials for Electrochemical Energy Storage and Conversion-Batteries, Capacitors and Fuel Cells, *Mater. Res. Soc. Symp. Proc.* 1995, 393, 265.
21. "Copper Deposition on HF Etched Silicon Surfaces : Morphological and Kinetic Studies", Chyan, O. M. R.; Chen, J.J.; Chien, H.Y.; Sees, J.; Hall, L.; *J. Electrochem. Soc.*, 1996, *143*, 92.

22. "Pulsed Plasma Polymerization of Tetramethyltin: Nanoscale Film Chemistry Composition Control", Chen, X.; Rajeshwar, K.; Timmons, R.B.; Chen, J.J.; Chyan, O. M. R.; *Chem. Mater.*, 1996, 8, 1067.
23. "A New Potentiometric Sensor For the Detection of Trace Metallic Contaminants in Hydrofluoric Acid", Chyan, O. M. R.; Chen, J.J.; Chien, H.Y.; Wu, J.J.; Liu, M.; Sees, J.; Hall, L., *J. Electrochem. Soc.*, 1996, 143, L235.
24. "Porous Silicon Coated with Calixarene Carboxylic Acid Derivatives: Effects on Luminescence Quenching Selectivity", Zhang, L.; Coffey, J.L.; Wang, J.; Gutsche, C.D.; Chen, J.J.; Chyan, O. M. R., *J. Am. Chem. Soc.*, 1996, 118, 12840.
25. "Potentiometric Investigation of Silicon Electrode Immersed in Alkaline Hydrogen Peroxide Solution Containing Trace Level of Iron", Chyan, O. M. R.; Chen, J.J.; L. Chen; F. Xu, *J. Electrochem. Soc.*, 1997, 144, L17.
26. "Discrete Metal Deposition on Hydrogen Terminated Silicon Surfaces: Kinetics, Morphologies and Sensor Applications", Chyan, O. M. R.; Chen, J.J.; Wu, J.; Chien, H.Y., *Mater. Res. Soc. Symp. Proc.* 1997, 451, 267.
27. "Trace Level Organics in Hydrofluoric Acid Determined by Attenuated Total Internal Reflection Infrared Spectroscopy", Chyan, O. M. R.; Chen, J.J.; Xu, F.; Wu, J., *Anal. Chem.*, 1997, 69, 2434.
28. "Comparative Studies of Hydrogen Termination on Single Crystal Silicon Surfaces by FTIR and Contact Angle Measurements", Chyan, O. M. R.; Wu, J.; Chen, J.J., *Applied Spectroscopy*, 1997, 51, 1905.
29. "Study of Fluoride Induced Dissimilar Metal Corrosion in a Microelectromechanical System", Prasad, J.; Chyan, O.M.R.; Chen, J.J.; Liu, M.; Chen, L.; Xu, F., *J. Mater. Res.*, 1997, 12, 3241.
30. "An Apparatus and Method for Detecting Impurities in Wet Chemicals", Hall, L; Sees, J; Chyan, O. M. R. ; *U.S. Patent*, 6,145,372, 2000.
31. "Ultrapure Water Quality Monitoring by a Silicon-based Potentiometric Sensor", Chyan, O. M. R. ; Chen, J.J.; Xu, F.; Wu, J.; Sees, J.; Hall, L , *The Analyst* , 2000, 125, 175.
32. "Qualitative and Quantitative Study of Silicon Wafer Surfaces Using ATR/FTIR Spectroscopy", Chen, J.J.; Xu, F.; Ponnuswamy, T.; Chan, R.; Wu, J.J.; Prasad, A.; Chyan, O. M. R. ; Sees, J. A.; Hall, L. H., *Recent Res. Devel. Applied Spectroscopy*, 2000, 3, 81.
33. "Preparation and Characterization of Metal Nanoparticles on a Diamond Surface", Gao, J.; Arunagiri, T.N.; Chen, J.J.; Goodwill, P.; Chyan, O. M. R. ; Perez, J.; Golden, D., *Chem. Mater.*, 2000, 12, 3495.
34. "Deposition of Metal Nanoparticles on Diamond Surface Via a Solution Route", Arunagiri, T.N.; Chen, J.J.; Gao, J.; Goodwill, P.; Chyan, O. M. R. ; Proceeding for the Electrochemical Society National Meeting, Phoenix, Arizona, 2001.
35. "Monitoring Metal Ion Contamination Onset in Hydrofluoric Acid Using Silicon/Diamond

- and Dual Silicon Sensing Electrode Assembly", Ponnuswamy, T.; Chen, J.J.; Xu, F., Chyan, O. M. R. , *Analyst*, 2001 ,126, 877.
36. "Response of Ceriodaphnia Dubia to Ionic Silver: Discrepancies Among Model Predictions, Measured Concentrations and Mortality", Peng, H.; Brooks, B.W.; Chan, R.; Chyan, O. M. R. ; La Point, T.W., *Chemosphere*, 2002, 46, 1141.
  37. "Preparation and Characterization of a Novel Infrared Sensor for Nickel Detection", Ponnuswamy, T.; Chyan, O. M. R. ; *Analytical Science*, 2002, 18, 449.
  38. "Preparation and Characterization of Electrolessly Deposited Platinum and Palladium Nanoparticles on Pyrolyzed Photoresist Films on Silicon Substrates", Liang, V.L.; Chan, R.; Chyan, O. M. R. ; *J. Am. Undergrad. Res.*, 2002, 1, 1.
  39. "Electrodeposition of Copper Thin Film on Ruthenium: a Potential Diffusion Barrier for Cu Interconnects", Chyan, O. M. R. ; Ponnuswamy, T.; and Arunagiri, T.N.; *J. Electrochem. Soc.*, 2003, 150, 347.
  40. "Interfacial Characterization of Copper Thin Film on Ruthenium: a Potential Diffusion Barrier for Cu Interconnects", Chyan, O. M. R. ; Chan, R.; Arunagiri, T.N.; Zhang, Y.; Hurd, T. *Proceeding of 4th AVS International Conference on Microelectronics and Interface*, page 103, 2003.
  41. "Electrodeposition of Silver and Copper/Silver Multilayer on Ruthenium Substrate as a Potential New Metal Interconnects for Integrated Circuits", Cheng, C.; Arunagiri, T.N.; Chyan, O. M. R. ; *J. Am. Undergrad. Res.*, 2003, 2, 11.
  42. "Diffusion Studies of Copper on Ruthenium Thin Film: a Plate-able Copper Diffusion Barrier", Chan, R.; Arunagiri, T.N.; Zhang, Y.; Chyan, O. M. R. ; Wallace, R.M.; Kim, M.J., *Electrochem. Solid-State Lett.*, 2004, 7, G154.
  43. "Underpotential Deposition of Copper on Electrochemically Prepared Conductive Ruthenium Oxide Surface", Zhang Y.; Long, L.; Arunagiri, T.N.; Ojeda, O.; Flores, S.; Chyan, O. M. R. ; Wallace, R.M, *Electrochem. Solid-State Lett.*, 2004, 7, C107.
  44. "Ruthenium-based Copper Diffusion Barrier :Studied by Electrochemistry, SIMS Depth Profiling and Sheet Resistance Measurements" Chyan, O. M. R. ; Chan, R.; Arunagiri, T.N.; Wallace, R. W.; Kim, M.J.; Hurd, T., *Proceeding of 204<sup>th</sup> International Meeting of the Electrochemical Society.*, page 118, 2004.
  45. "Method of Using Materials Based on Ruthenium and Iridium and Their Oxides, As a Cu Diffusion Barrier, and Integrated Circuits Incorporating Same" Chyan, O. M. R. and Ponnuswamy, T.; *U.S. Pat. Appl. Publ. # 60/393,204*, 2004, 11 pages.
  46. "Ruthenium: a Promisingly New Diffusion Barrier for Copper Interconnects for 65 and 45 nm Integrated Circuits Technology Nodes", Arunagiri, T.N.; Misra, A. ; Chyan, O. M. R. , *Indian Surface Finishing*. 2005, 2, 46.
  47. "Study of Palladium Metal Particle Deposition on the Conductive Diamond Surface by XRD, XPS and Electrochemistry", Arunagiri, T.N.; Golden, T. D.; Chyan, O. M. R. , *Mater. Chem. & Phys.*, 2005, 92, 152.
  48. "Ultrafine Platinum Nanoparticles Uniformly Dispersed on Arrayed CNx Nanotubes with High

- Electrochemical Activity", Sun, C.L.; Chen, L.C.; Su, M. C.; Hong, L. S.; Chyan, O. M. R. ; Hsu, C. Y.; Chen, K.H.; Chang, T.F.; Chang, L., *Chem. Mater.*, 2005, 17, 3749.
49. "A 5 nm Ruthenium Thin Film as a Directly Plate-able Copper Diffusion Barrier ", Arunagiri, T.N.; Zhang, Y.; Chyan, O. M. R. ; El-Bounani, M. ; Kim, M.J.; Wu, C. T.; Chen, K. H.; and Chen, L. C., *Appl. Phys. Lett.* , 2005, 86, 083104.
  50. "Interfacial Diffusion Studies of Cu/(5 nm Ru)/Si Structures: Physical Vapor Deposited vs. Electrochemically Deposited Cu", Arunagiri, T.N.; Zhang, Y.; Chyan, O. M. R. ; Kim, M.J.; Hurd, Q. T., *J. Electrochem. Soc.*, 2005, 152, G808.
  51. "Photochemically Induced Metallization of Surface Silicon Using Dinuclear Metal Carbonyl Compounds. Anchoring of Ruthenium to a Si(111) Surface Through Covalent Ru-Si Bond Formation ", Nalla, P.; Huang S.H.; Zhang, Y.; Chyan, O. M. R. ; Richmond, M.G.; El Bouanani, M. , *Chem. Mater.*, 2005, 17, 5951.
  52. " Analytical TEM characterization of metal penetration and supercritical pore-sealing of ash-damaged porous low-k dielectrics ", Gorman, B. P.; Mueller, D. W.; Chyan, O. M. R. ; Reidy, R. F; Advanced Metallization Conference, 2006, 393-397.
  53. "Enhanced electrochemical properties of arrayed CN<sub>x</sub> nanotubes directly grown on Ti-buffered silicon substrates", Fang, W.C.; Huang, J.H.; Sun, C.L.; Chen, L.C.; Chyan, O. M. R. ; Chen, K.H.; Papakonstantinou, P.; *J. Electrochem. Soc.*, 2006, 9, A175-A178.
  54. " Arrayed CN<sub>x</sub> NT–RuO<sub>2</sub> nanocomposites directly grown on Ti-buffered Si substrate for supercapacitor applications ", Fang, W.C.; Chyan, O. M. R. ; Sun, C.L.; Wu, C.T.; Chen, C.P., Chen, K.H.; Chen, L.C., Huang, J.H., *Electrochemical Communication* , 2007, 9, 239-244.
  55. "Method of Making Integrated Circuits Using Ruthenium and Its Oxides as Cu Diffusion Barrier", Chyan, O. M. R. Ponnuswamy, T.; *U.S. Patent No. 7247554*, 2007.
  56. " Immobilization of biomolecules on pulsed plasma polymerized poly(vinylacetic acid) thin films ", Bhattacharyya, D.; Pillai, K.; Chyan, O. M. R.; Tang, L.; Timmons, R. B., *ACS Polymeric Materials Science and Engineering Preprints*, 2007, 96, 340-341.
  57. " A New Class of Thin Film Hydrogels Produced by Plasma Polymerization ", Bhattacharyya, D.; Pillai, K.; Chyan, O. M. R. Tang, L.; Timmons, R. B., *Chem. Mater.*, 2007, 19(9), 2222-2228.
  58. " Metal Electrodeposition on an Integrated Screen-Printed Electrode Assembly", Chyan, Y.; Chyan, O. M. R. *Journal of Chemical Education*, 2008, 85(4), 565-567.
  59. " Developing a Rapid Screening Metrology for Cu Corrosion in CMP Relevant Chemical Environments", Yu, K.; Chyan, O. M. R., *Proceeding of International Conference on Planarization/CMP Technology*, 2008, pp 316-321.
  60. " Investigation of Cu Bimetallic Corrosion in CMP Chemical Environments using Micropattern Corrosion Screening", Nalla, P.; K. Pillai; Yu, K.; Venkataraman, S. Chyan, O M.R.; *Proceeding of 2009 Advanced Metallization Conference*, 2009. pp 83-91.

61. " Mesoporous active carbon dispersed with ultra-fine platinum nanoparticles and their electrochemical properties", Hwang, J. Y.; Chatterjee, A.; Shen, C. H.; Wang, J. H.; Sun, C. L.; Chyan, Oliver; Chen, C. W.; Chen, K. H.; Chen, L. C., *Diamond and Related Materials*, 2009, 18, 303-306
62. " Study of Bimetallic Corrosion in Chemical-Mechanical Planarization using Corrosion Screening Micropattern and Tafel Plots" Yu, K.; K. Pillai; Nalla, P.; Chyan, O. M. R., *Journal of Applied Electrochemistry*, 2010, 40, 14359.
63. " Enhancement of the energy photoconversion efficiency through crystallographic etching of a c-plane GaN thin film", Antonio M. Basilio, Yu-Kuei Hsu, Wen-Hsun Tu, Cheng-Hsuing Yen, Geng-Ming Hsu, Oliver Chyan , Li-Chyong Chen and Kuei-Hsien Chen, *Journal of Materials Chemistry* , 2010, 20, 8118-8125.
64. " Study of Cu bimetallic corrosion in CMP chemical environments using optical scanning and micropattern corrosion screening" Yu, K. K.; Thomas, N.; Venkataraman, . S.; Pillai, K. S. M.; Hurd, T. Q.; Boggs, K.; Chyan, O.M.R.; *ECS Transactions* , 2011, 35, 173-184.
65. "Wafer Fabrication Monitoring/Control System and Method" Chen, J.J.; Chyan, O.M.R.; *United State Provisional Patent Application*, serial number 61/465,154, 2012, 145 pages.
66. " Characterization of Post Etch Residues on Patterned Porous Low-k using Multiple Internal Reflection Infrared Spectroscopy " Rimal, S.; Ross, N.; Pillai, K. S.M.; Singh, K.J., Chyan, O.M.R.; *ECS Transactions* , 2012, 41, 315-322
67. "Bonding Structure of Model Fluorocarbon Polymer Residue Determined by Functional Group Specific Chemical Derivatization " Mukherjee, T.; Rimal, S. ; Koskey, S.; Chyan, O.M.R.; Singh, K.J., Myers, A.M., *ECS Solid State Letters*, 2013, 2(3), N11-N14 .
68. "Interfacial Characterization of Post-Etch Polymer Residues and Plasma Treated Cu Surfaces related to Advanced Cu Interconnects", Rimal, S. ; Koskey, S.; Mukherjee, T Goswami, A.; Abdelghani, J.; Ross, N.; Chyan, O.M.R. *Proceeding of SEMICON 2013*.
69. "Characterization of Boron Doped Amorphous Silicon Films by Multiple Internal Reflection Infrared Spectroscopy" Ross, N.; Shrestha, K.; Chyan, O. M.R.; Littler, C. L.; Lopes, V. C.; Syllaios, A.J.; *MRS Proceedings*, 2013, 1536, mrss13-1536-a17-04 doi:10.1557/opl.2013.752.
70. "Evaluation of plasma damage to low-k dielectric trench structures by multiple internal reflection infrared spectroscopy" Rimal, S.; Mukherjee, T.; Abdelghani, J.; Goswami, A.; Chyan, O. M.R.; Stillahn, J.; Chiba, Y.; Maekawa, K., *ECS Solid State Letters* 2014, 3(3), N1-N4.
71. "Study of Pyrazole as Copper Corrosion Inhibitor in Alkaline Post Chemical Mechanical Polishing Cleaning Solution" Goswami, A.; Koskey, S.; Mukherjee, T.; Chyan, O. M.R., *ECS J. Solid State Sci. Technol.* 2014, 3(10), P293-P297
72. "UV-assisted Modification and Removal Mechanism of a Fluorocarbon Polymer Film on Low-k Dielectric Trench Structure" Mukherjee, T.; Berhe, S.A.; Goswami, A.; Chyan, O. M.R.; Singh, K. J.; Brown, I., *ACS Appl. Mater. Interfaces*, 2015, 7, 5051-5055.

73. "Exploration of Chemical Bonding Transformation Mapping to Assist Low-k Dielectric Nanostructure Fabrication" Rimal, S.; Mukherjee, T.; Goswami, A.; Ross N.; *ECS Transactions* , 2015, 66, 1-13.
74. "Study of Bimetallic Corrosion and Its Inhibition Strategy for Cu Interconnect and IC Packaging Using Micro-Pattern Corrosion Screening" Ross N.; Goswami, A.; Berhe, S.A.; Lin P. ; Snitker J.; Chyan, O.M.R.; 2015 *TECHCON Proceeding*, sponsored by Semiconductor Research Corporation, 2015.
75. " Micro-pattern Corrosion Screening on Bimetallic Corrosion for Microelectronic Application" Yu, K.; Rimal, S.; Asokan, M.; Nalla, P.; Koskey, S.; Pillai, K.; Chyan, O.M.R.; Singh, K.J.; Suri, S.; *Electrochimica Acta* , 2016, 210, 512–519 (Invited Paper)
76. "Wafer Fabrication Monitoring/Control System and Method" Chen, J.J.; Chyan, O.M.R.; *U.S. Patent* 9366601, 2016.
77. "Aluminum Bond Pad Corrosion of Wirebond Packages " Mathew, V.; Chopin, S.; Chyan, O.M.R.; Ross, N.; Lambert, A.; and Asokan, M., *International Symposium on Microelectronics Proceeding*, Vol. 2016, No. 1, 227-233, 2016. (Committee reviewed)
78. "Systems and Methods for Copper Etch Rate Monitoring and Control”, Lambert, A.; Chyan, O.M.R.; *U.S. Provisional Patent* 62432115, 2016
79. "Aluminum Bond Pad Corrosion of Wirebond Packages " Mathew, V.; Chopin, S.; Chyan, O.; Ross, N.; Lambert, A.; and Asokan, M.; International Microelectronics Assembly and Packaging Society, iMAPS-2016 proceeding, 2016.
80. "Thin-Film UV-Vis Spectroscopy as a Chemically-Sensitive Monitoring Tool for Copper Etching Bath" Lambert, A.; Asokan, M.; Ashok Kumar, G. I.; Love, C.; Chyan, O.M.R., *Journal of Industrial and Engineering Chemistry*, 2017, 51, 44–48.
81. "Mechanistic Investigation and Prevention of Al Bond Pad Corrosion in Cu Wire-bonded Device Assembly" Chyan, O.M.R.; Ross, N.; Lambert, A.; Asokan, M.; Berhe, S., Chowdhury, M.; Connor, S.O.; Nguyen, L., *IEEE Electronic Components and Technology Conference, ECTC-2017 Proceeding*, 2017.
82. "Mechanistic Investigation and Prevention of Al Bonded Pad Corrosion in Cu Wire-bonded Device Assembly”, Ross, N.; Chyan, O.M.R.; *US Provisional Patent* # 62/511,863. 2017.
83. "Aluminum Bond Pad Corrosion in Copper Wire Bonded Assembly – Defectivity characterization and Prevention Strategy" Chyan, O.M.R.; Asokan, M.; Berhe, S., Chowdhury, M.; Connor, S.O.; Nguyen, L., 2017 *TECHCON Proceeding*, sponsored by Semiconductor Research Corporation, 2017.
84. "Optimization of Cupric Chloride Subtractive Etching for Cu High Density Interconnects " Lambert, A.; Ashok Kumar, G. I.; Salunke, A, Lu, L.; Chyan, O.M.R.; Ojeda, O.; Ecton, J.; Roy, A.; Wang, H.; Arana, L., *International Microelectronics Assembly and Packaging Society*, IMAPS-2018 proceeding, 2018.
85. "Explore High Bonding Reliability of Cu Wire Bonded Devices under Extreme Halide Contaminated Environments " Chyan, O.M.R.; Asokan, M.; Caperton, A.; Salunke, A.; Xu,

- F.; *International Microelectronics Assembly and Packaging Society*, IMAPS-2018 proceeding, 2018.
86. "Novel Corrosion Prevention Treatments for Cu Wire Bonded Device to Improve Bonding Reliability" Asokan, M.; Caperton, Z.; Chyan, O.M.R.; Chowdhury, M.; Connor, S.O.; Nguyen, L., *IEEE Electronic Components and Technology Conference, ECTC-2018 Proceeding*, 2018.
  87. "Mechanistic study of copper wire-bonding failures on packaging devices in acidic chloride environments" Ross, N.; Asokan, M.; Ashok Kumar, G. I.; Caperton, J.; Alptekin, J.; Salunke, A. S.; Chyan, O.M.R., *Microelectronics Reliability* **2020**, *113*, 113917.
  88. "Accelerated Reliability Testing of Cu-Al Bimetallic Contact by a Micropattern Corrosion Testing Platform for Wire Bond Device Application" Ashok Kumar, G. I.; Alptekin, J.; Caperton, J.; Salunke, A.S.; Chyan, O.M.R., *MethodsX*. **2021**, *8*, 101320
  89. "Comparative Study of Chloride and Fluoride Induced Aluminum Pad Corrosion in Wire-Bonded Device Packaging Assembly" Ashok Kumar, G. I.; Lambert, A.; Caperton, J.; Asokan, M.; Yi, W.; Chyan, O.M.R., *Corros. Mater. Degrad.* **2021**, *2*, 447–460.
  90. "Systems and Methods for Copper Etch Rate Monitoring and Control", Lambert, A.; Chyan, O.M.R.; *U.S. Patent* 11099131, **2021**.
  91. "Investigation of CuAl IMCs Corrosion in Chloride Environment and its Prevention Strategy" Alptekin, J.; Gopalakrishnan, E.; Kumaravel D.; Antony K.; Chyan, O.M.R.; Varughese Mathew, V., *International Microelectronics Assembly and Packaging Society*, IMAPS-2022 proceeding, PP 217-224, 2022.
  92. "Prevention of Cu Electrolytic Migration Defects on RDL by a Cu-selective Passivation to Enhance Reliability " Salunke, A.; Akula, K.; Jayakumar, S.; Kumar, S.; Alptekin, J.; Chyan, O.M.R., *Journal of Microelectronics and Electronic Packaging*, **2023**, *20*, 17–26.
  93. "Cu-Cu Wire-Bonding Enabled by a Cu-selective Passivation Coating to Enhance Packaging Reliability " Alptekin, J.; Antony Jesu Durai, K.; Kumaravel, D. K.; Estridge, L.; Chyan, O.M.R., Ibrahim, R.; Li, G. M., Mathew, V. *IEEE Transactions on Components, Packaging and Manufacturing Technology*, **2023**, *13*, 1923-1928. <https://doi.org/10.1109/TCPMT.2023.3334889>
  94. "Exploration of Interfacial Materials Chemistry Control to Improve Cu Wire Bonding Reliability " Antony Jesu Durai, K.; Kumaravel, D. K.; Alptekin, J.; Estridge, L.; Nair, S.; Chyan, O.M.R., *International Microelectronics Assembly and Packaging Society*, *IMAPS Proceedings 2023 (Symposium)*: 320–27.
  95. "Exploration of Interfacial Materials Chemistry Control to Improve Cu Wire Bonding Reliability " Antony Jesu Durai, K.; Kumaravel, D. K.; Alptekin, J.; Estridge, L.; Nair, S.; Chyan, O.M.R., *Journal of Microelectronics and Electronic Packaging*, **2024**, *21* (2): 42–49. <https://doi.org/10.4071/001c.119026>
  96. "Enhancing Cu Wire-Bonding Reliability by a Cu-Selective Passivation Coating" Kumaravel, D. K.; Antony Jesu Durai, K.; Alptekin, J.; Nair, S.; Chyan, O.M.R.; Mathew, V. *IEEE Electronic Components and Technology Conference, ECTC-2024 Proceeding*,

- 2024**, pp. 1206-1212.
97. "Innovative Cu-Selective Passivation Coatings for Enhanced Reliability in Cu Interconnects for IC Packaging" Kumaravel, D. K.; Antony Jesu Durai, K.; Nair, S.; Tran, K.T.A.; Chyan, O.M.R.; Ramarao Poliah, R.; Chan, M. Z.; Mathew, V. *IEEE 26th Electronics Packaging Technology Conference, EPTC-2024 Proceeding*, **2024**, pp. 534-540.
  98. "Ion-Induced Phase Changes in 2D MoTe<sub>2</sub> Films for Neuromorphic Synaptic Device Applications" Rupom, R.H.; Jung, M.; Pathak, A; Park, J.; Lee, E.; Ju, H. A.; Kim, M.K. Chyan, O.M.R.; Kim, J.K.; Suh, D.; Choi, W. *ACS Nano*, *19* (2), 2529-2539, **2025**.  
<https://doi.org/10.1021/acsnano.4c13915>
  99. "Enhancing Wafer-Level Cu-Solder Bonding: A Fluxless Approach with Cu-Selective Passivation Coating" Antony Jesu Durai, K.; Kumaravel, D. K.; Nair, S.M.; Tran, K.T.A.; Chyan, O.M.R.; *IEEE Electronic Components and Technology Conference, ECTC-2025 Proceeding*, **2025**, pp. 1069-1074.
  100. "Exploration of Cu Interfacial Engineering to Enhance Cu Interconnects Reliability" Antony Jesu Durai, K.; Kumaravel, D. K.; Nair, S.M.; Tran, K.T.A.; Nair, S. S., Chyan, O.M.R.; *IEEE European Microelectronics & Packaging Conference, EMPC-2025 Proceeding*, **2025**, pp. 1-8.
  101. "Facilitating High-Reliability Cu-to-Cu Direct Bonding via Tunable Cu-selective Oxide suppression Coating for Advanced Interconnects" Antony Jesu Durai, K.; Kumaravel, D. K.; Tran, K.T.; A.; Perera, D. A. S.; Chen, H. C.; Chiu, P. W.; Chen, K.H.; Chyan, O.M.R., *International Microelectronics Assembly and Packaging Society, IMAPS Proceedings*, **2025**, pp. 202–208.
  102. " Investigation of Cu-Cu Stitch Bonding Reliability on Cu Leadframe Substrate Using Ultrathin Cu-Selective Passivation" Nair, S.M.; Perera, D. A. S.; Farmer, G.; Abraham, J.; Tran, K.T.A.; Philipose, U.; Chyan, O.M.R., *International Microelectronics Assembly and Packaging Society, IMAPS Proceedings*, **2025**, pp. 194-201.
  103. " Copper Interfacial Engineering for Oxide-Suppressed, Fluxless Cu-Solder and Cu-to-Cu Thermocompression Bonding" Antony Jesu Durai, K.; Kumaravel, D. K.; Tran, K.T.A.; Perera, D. A. S.; Chyan, O.M.R., *IEEE International Microsystem, Packaging, Assembly and Circuit Technology Conference (IMPACT 2025)*, pp. 90-93.
  104. " Post Wire-Bonding Corrosion Prevention Strategies to Mitigate Chloride- and Bromide- Induced Corrosion Failures in Cu and PCC-Based Wire-Bonded Packages " Kumaravel, D.K.; Nair, S.S.; Tran, K.T.A.; Ahluwalia, P.; Antony Jesu Durai, K.; Chyan, O.M.R., *Micromachines* **2025**, *16*, 1155. <https://doi.org/10.3390/mi16101155>
  105. " Enhancing Cu-Cu Stitch Bonding Reliability on Cu Leadframe Through Ultrathin Cu-Selective Passivation" Nair, S.M.; Perera, D. A. S.; Farmer, G.; Abraham, J.; Tran, K.T.A.; Philipose, U.; Chyan, O.M.R., *Journal of Microelectronics and Electronic Packaging*, **2026**, **accepted**.

106. "Engineering a Tunable Cu-Selective Oxide-Suppressing Coating to Enable Reliable Cu-to-Cu Direct Bonding for Advanced Interconnects " Antony Jesu Durai, K.; Perera, D. A. S.; Tran, K.T.A.; Kumaravel, D. K.; Chen, H. C.; Chiu, P. W.; Chen, K.H.; Chyan, O.M.R., *Journal of Microelectronics and Electronic Packaging*, **2026, accepted.**

### Invited Lectures and Seminars

1. "Surface Electrochemistry", National Chung-Hsing University, Taichung, Taiwan, (1993).
2. "Metal Deposition Induced Surface Roughening on Hydrogen Terminated Silicon Wafer Surfaces", the North Texas Section of the Electrochemical Society, Dallas, Texas. (1994).
3. "Interfacial Studies of Metal Deposition on Hydrogen Passivated Silicon Surfaces", University of Texas at Arlington, Arlington, Texas. (1995)
4. "Interfacial Characterization of Metal Deposited Silicon Wafer Surfaces", Texas Christian University, Forth Worth, Texas (1995)
5. "Scanning Probe Microscopy Techniques: Electrochemical and Microelectronic Applications" The South Texas Section of the Electrochemical Society, Houston, Texas. (1995)
6. "Electrochemical Aspects in the Silicon Wafer Cleaning and Contamination Controls", The Second Joint Meeting of North and South Texas Section of the Electrochemical Society, Houston, Texas. (1996)
7. "Interfacial Characterization of Hydrogen Terminated Silicon Wafer Surfaces: Kinetics, Morphologies and Sensor Applications.", Texas A&M University, (1996)
8. "Nanoscale Chemistry on Silicon Surface and Its Applications in Integrated Circuits Fabrication", University of Missouri at Rolla. (1997)
9. "Surface Chemistry of Silicon and Its Applications to Microelectronics Industry", Taiwan Academia Sinica, Taipei, Taiwan. (1997)
10. "Sensitive Detection of Ultra-trace Metal and Organic Contaminants Using a Silicon-Based Sensor", Project Advisory Board Meeting, SEMATECH. (1997)
11. "Trace Silver Measurement Utilizing a Silicon-based Sensing Electrode", the Fifth International Conference on Transport, Fate and Effects of Silver in the Environment, Hamilton, Ontario, Canada. (1997)
12. "Characterization of Trace Impurities in Microelectronics Processing Chemicals Using a Silicon based Sensor", Utah State University, Logan, Utah. (1997)
13. "Nanoscale Silicon Surface Chemistry and Its Applications to Integrated Circuit Fabrication", University of Utah, Salt Lake City, Utah. (1997)
14. "Characterization of Trace Impurities in Microelectronics Processing Chemicals Using a Silicon based Sensor", University of Texas at Dallas, Dallas, Texas. (1997)

15. "Monitoring Ultra-trace Impurities in IC processing Chemicals Using a Silicon -based Sensor", Georgia Institute of Technology, Atlanta, Georgia. (1997)
16. "Nanoscale Silicon Surface Chemistry and Its Applications to Integrated Circuit Fabrication", University of Georgia, Athens, Georgia. (1997)
17. "Interfacial Characterization of Discrete Metal Deposition on Silicon Surfaces: Morphologies, Kinetics, Catalysis and Sensor Applications", Massachusetts Institute of Technology. (1998)
18. "Trace Silver Detection in Natural Waters Using Silicon-based Sensor and Matrix Isolation Technique", Eastman Kodak, Rochester, New York. (1999)
19. "Development of a Solid State Chemical Sensor for Environmental Applications", Institute of Applied Science, University of North Texas, Denton. (2000)
20. "Materials Chemistry of Silicon and Diamond in Hydrofluoric Acid Environment", Materials Science Department, University of North Texas, Denton. (2000)
21. "Silicon Materials Chemistry and it's Applications in Microelectronics Industry", Chemistry Department, Texas A&M University, Commerce. (2000)
- 22.. "Materials Chemistry of Silicon wafer and its Microelectronics Applications", College of Chemistry, Universidad Autonoma De Coahuila, Saltillo, Mexico, (2001)
23. "Interfacial Characterization of Discrete Metal Deposition on Hydrogen Terminated Silicon and Diamond Surfaces", College of Chemistry, Peking University, China. (2002)
24. "Electrochemistry on silicon wafer and it's Microelectronics Applications", Institute of Microelectronics, Peking University, China. (2002)
25. "The Physical and Chemical Aspects of the Selected Interfaces that have both Academic Significance and Industrial Applications", College of Chemistry, Nankai University, China. (2002)
26. "The Materials Aspects of Metal/Dielectrics/Silicon Wafer for IC Chip Production", Department of Materials Science, Nankai University, China. (2002)
27. "Materials Research Based on Silicon Wafer and Metal Surfaces: Application to Advanced Integrated Circuit Fabrication", Chemistry Department of National Chung-Hsing University, Taiwan. (2002)
28. "Interfacial Electrochemistry and its Application to the Cu Diffusion Barrier Integrated Circuit Fabrication", Applied Materials Inc., Santa Clara. (2003)
29. "Recent Advances on Direct Plate-able Ruthenium Based Cu Diffusion Barrier Research at the UNT Interfacial Electrochemistry and Materials Research Laboratory", Texas Instruments Inc., Richardson, Texas. (2003)
30. "Interfacial Studies of Copper Thin Film on Ru and RuO<sub>2</sub>: a New Cu Diffusion Barrier", SEMATECH, Austin. (2003)
31. "Interfacial Chemistry on Silicon and Diamond Surfaces", University of Houston, Houston. (2003)

32. "Recent Development of Metal Deposition on Ruthenium and Ruthenium Oxide Surfaces", Materials Science Division, Argonne National Laboratory, Argonne, Illinois. (2003)
33. "Silicon Materials Chemistry and Its Applications to Integrated Circuit Fabrication", Texas Instruments, SiTD Interconnect Seminar, Richardson, Texas. (2003)
35. "Silicon Materials Chemistry and Its Applications to Integrated Circuit Fabrication", Department of Chemical Engineering, National Cheng-Kong University, Taiwan. (2003)
36. "Interfacial Diffusion study of Cu Across a 5 nm Ultra-thin Ru-based Cu Diffusion Barrier", Center of the Condensed Materials, National Taiwan University, Taiwan. (2003).
38. "Recent Progress in Anchoring Nanomaterials on Silicon and Metal Surfaces", Center of the Condensed Materials, National Taiwan University, Taiwan. (2004)
49. " Interfacial Engineering of Ultra-thin Ruthenium Diffusion Barriers for Advanced Interconnect Applications", National Taiwan University, Taiwan. (2007)
50. "Materials Chemistry of Ruthenium and its Applications in Microelectronics and Alternative Energy Production", National Cheng-Kung University, Taiwan. (2007)
51. "Interfacial Engineering of Ultra-thin Ruthenium Diffusion Barriers for Advanced Interconnect Applications", National Chung-Hsing University, Taiwan. (2008)
52. "Investigation of Cu Corrosion in Cu-CMP and Post CMP Related Chemical Environments ", ATMI, Danbury, Connecticut. (2008)
53. "Electrochemical Investigation of Cu Corrosion in Cu-CMP and Post-CMP Solution Environments", Semiconductor Research Corporation / Center for Advanced Interconnect Science and Technology program Review, Albany, New York. (2008)
54. "Investigation of Cu Corrosion in Cu-CMP and Post-CMP Processing Environments", Semiconductor Research Corporation / Center for Advanced Interconnect Science and Technology program Review, Albany, New York. (2009)
55. "Recent advances in Interfacial Electrochemistry Applied to Microelectronics and Alternative Energy Production", Center of the Condensed Materials, National Taiwan University, Taipei, Taiwan. (2010).
56. "Recent advances in Interfacial Electrochemistry Applied to Microelectronics and Alternative Energy Production", Department of Materials Science and Engineering, National Donghua University, Taiwan. (2010).
57. "Electrochemical Investigation of Cu Corrosion in Cu-CMP and Post-CMP Solution Environments", Semiconductor Research Corporation / Center for Electronic Material Processing and Integration program Review, UNT, Denton. (2010)
58. "Characterization of Plasma-Etch-Polymers Using MIR-IR Spectroscopy", Semiconductor Research Corporation / Center for Electronic Material Processing and

- Integration program Review, UNT, Denton. (2011)
59. "Electrochemical Investigation of Cu Corrosion in Cu-CMP and Post-CMP Solution Environments", Semiconductor Research Corporation / Center for Electronic Material Processing and Integration program Review, UNT, Denton. (2011)
  60. "Interfacial Engineering of Ultra-thin Ruthenium Diffusion Barriers for Advanced Interconnect Applications", Department of Materials Science and Engineering, National Chiao Tung University, Taiwan. (2012)
  61. "Wafer Monitoring Metrology for Etching, Ashing and Cleaning on Patterned Porous Low-k ", Lam Research Inc., California. (2012)
  62. "Development of an Effective Monitoring Metrology for Etching, Ashing and Cleaning on Patterned Porous Low-k ", Novellus Inc., Oregon. (2012)
  63. "Interfacial Characterization of Post Etch Polymer Residues and Plasma Treated Cu Surfaces related to Advanced Cu Interconnects", Intel, Oregon. (2012)
  64. "Electrochemical Investigation of Cu Corrosion in Cu-CMP and Post-CMP Solution Environments", Semiconductor Research Corporation / Center for Advanced Interconnect Science and Technology program Review, Albany, New York. (2012)
  65. "Interfacial Characterization of Post Etch Polymer Residues and Plasma Treated Cu Surfaces related to Advanced Cu Interconnects", SEMICON-Korea (2013)
  66. " Characterization of Hydrogenated Amorphous Silicon Thin Film by Multiple Internal Reflection Infrared Spectroscopy", L3 Communication, Plano, Texas. (2013)
  67. "MIR-IR Characterization of Plasma Induced Low-k Damages and Post Etch Polymer Residues", ATMI Inc, USA. (2014)
  68. "Develop a Novel Metrology to Characterize low-k Dielectric Nanostructure related to Advanced Cu Interconnects ", Chang Gung University, Taiwan. (2014)
  69. "Interfacial Characterization of low-k Dielectric Nanostructure related to Advanced Cu Interconnects", 20th Annual Taiwan Analytical Conference, Taiwan National Science Foundation, Taiwan. (2014)
  70. "Chemical Bonding Transformation Mapping to Optimize Low-k Dielectric Nanostructure Fabrication for Advanced Microelectronic Application ", National Chung-Hsing University, Taiwan. (2015)
  71. " Investigation of Al Pad Corrosion in the Cu Wire Bonded Semiconductor Device Assembly ", Semiconductor Research Corporation program Review, Georgia Institute of Technology, Atlanta, Georgia (2015)
  72. "Recent Development of Novel Characterization Metrology for Advanced Cu Interconnects", JSR Micro, Sunnyvale, CA. (2016)
  73. "Characterization of Microscopic Bimetallic Corrosion and Prevention Strategy for Microelectronic Fabrication" Advanced Coatings 2016, Houston, Texas. (2016)
  74. "Exploration of Chemical Bonding Transformation Mapping to Assist Low-k Dielectric Nanostructure Fabrication for Advanced Microelectronic Fabrication" IAMS at the Taiwan Academic Sinica, Taiwan (2016)

75. "Mechanistic Investigation and Prevention of Al Bond Pad Corrosion in Cu Wire Bonded Device Assembly ", Semiconductor Research Corporation program Review, Georgia Institute of Technology, Atlanta, Georgia (2016)
76. "Recent Development of Novel Characterization Metrology for Advanced Cu Interconnects" Taiwan Semiconductor Manufacturing Company, Taiwan (2016)
77. "Exploration of Chemical Bonding Transformation Mapping to Assist Low-k Dielectric Nanostructure Fabrication for Advanced Microelectronic Fabrication" the National Sun Yet-Sen University, Taiwan (2016).
78. "Chemical Bonding Transformation Mapping to Optimize Low-k Dielectric Nanostructure Fabrication and Post-etch Residue Clean", The Surface Preparation and Cleaning Conference (SPCC) at Austin, TX (2017).
79. "Optimize Low-k Dielectric Nanostructure Fabrication via Interfacial Bonding Engineering", Keynote Address to the North America Taiwanese Engineering & Science Association (NATEA) Conference at Dallas, TX (2017).
80. "Chemical Bonding Transformation Mapping of Super Critical Cleaning of Post-etch Residue on Low-k Dielectric Nanostructure Fabrication" the National Sun Yet-Sen University, Taiwan (2017).
81. "Explore High Bonding Reliability of Cu Wire Bonded Devices under Extreme Halide Contaminated Environments " Wire Bonding Workshop in International Microelectronics Assembly and Packaging Society Meeting, iMAPS-2018 , Pasadena, CA (2018).
82. "Chemical Bonding Transformation Mapping to Optimize Low-k Dielectric Nanostructure Fabrication for Advanced Microelectronic Application ", TSMC Fab 15, Taiwan. (2019)
83. "Chemical Bonding Transformation Mapping to Monitor Nano Photolithographic Processing", TSMC Fab 18, Taiwan. (2019)
84. "Chemical Bonding Transformation Mapping to Optimize Fabrication Process and Integration for Advanced Microelectronic Application ", Intel, Oregon (2019)
85. "Operational Principle of Highly Sensitive Multiple Internal Reflection Infrared Spectrometry for Chemical Bonding Mapping of Wafer Processing", Intel, Oregon (2019)
86. "Investigation of Chemical Bonding Transformation at Nanometer Domains for Microelectronic Fabrication Applications", the Institute of Chemistry of University of Philippines, Manila (2019)
87. "Investigation of Chemical Bonding Transformation at Nanometer Domains for Microelectronic Fabrication Applications", De La Salle University, Manila (2019)
88. "Instrumental Design and Fabrication of Highly Sensitive Multiple Internal Reflection Infrared Spectrometry Metrology for Advanced Microelectronic Application", Intel, Oregon (2020)
89. " Optimization of Cu-Selective Repassivation Treatments on Cu Redistribution Lines to Achieve Enhanced Reliability", Texas Instruments, Texas (2020)

90. " Optimization of Corrosion Prevention Treatments for Cu Wire- Bonded Devices to Achieve High Bonding Reliability ", NXP Semiconductor, Texas (2020)
91. " Copper Selective Passivation Coating for Direct Cu to Cu Bonding Application ", NXP Semiconductor, Texas (2021)
92. "Interfacial Chemistry Control to Enhance Advanced Microelectronic Fabrication and IC Packaging Reliability", UNT Materials Science and Engineering, Texas (2022)
93. " Eliminating Corrosion-Related Defects in Cu-Al Wirebonded Devices and Investigation of CuAl IMCs Corrosion in Chloride Environment", NXP Semiconductor, Taiwan (2022)
94. " Scale Up UNT Passivation Coating Technology with Mindox for NXP Cu Wire-Bonded Devices to Achieve High Bonding Reliability", Mindox Techno, Singapore (2022)
95. " Interfacial Chemistry Control to Enhance Advanced Microelectronic Fabrication and IC Packaging Reliability", Micro Technology, Idaho (2022)
96. "Interfacial Chemistry Control to Enhance Advanced Microelectronic Fabrication and Packaging Reliability ", Intel, Oregon (2023)
97. " Pilot Production Trials of UNT Passivation Coating Technology with Mindox/NXP to Achieve High Wire Bonding Reliability", Mindox Techno and NXP, Singapore (2023)
98. "Interfacial Engineering of Copper Interconnects to Enhance IC Packaging Reliability and Integration ", Invited talk to 2<sup>nd</sup> SRC/KEIT Conference, Austin Texas (2023)
99. "Interfacial Chemistry Control to Enhance Advanced Microelectronic Fabrication and IC Packaging Reliability" IAMS at the Taiwan Academic Sinica, Taiwan (2023)
100. "Interfacial Engineering to Enhance Advanced Microelectronic Fabrication and Packaging Reliability" National Sun Yat-Sen University, Taiwan (2023)
101. "Interfacial Chemistry Control to Enhance Advanced Microelectronic Fabrication and IC Packaging Reliability" CSIR - National Chemical Laboratory, India (2025)
102. "Development of a New Passivation Coating to Improve IC Packaging Reliability: from Interfacial Chemistry to Pilot Production" Indian Institutes of Science Education and Research, India (2025)
103. "Cu-Selective Passivation Coating : Enhance Cu Interconnect Reliability for Advanced IC Packaging", Infineon Technologies, Singapore (2025)
104. "Exploration of Novel Cu-selective Passivation Coating to Improve IC Packaging Reliability", BE Semiconductor Industries N.V. (Besi), Netherlands (2025)
105. "Explore Semiconductor Defects Passivation Mechanism Guided by Ultrasensitive Chemical Bonding Characterization Metrology" the National Sun Yet-Sen University, Taiwan (2025).
106. "Cu-Selective Passivation Coating : Enhance Cu Interconnect Reliability for Advanced IC Packaging", Kulicke & Soffa (K&S), USA (2025)
107. "UNT/TI Collaboration: Cu-Selective Passivation Coating to Enhance Reliability for Advanced IC Packaging", TI , USA (2025)

## Presentation at Technical and Professional Meetings

1. "Photoelectrochemistry of the Sn-doped Indium Oxide Coated Silicon Semiconductors", Chyan, O.M.R.; Rajeshwar, K.; American Chemical Society Meeting-in-Miniature, Dallas, Texas. (1984)
2. "Preparation of Photovoltaic Interface Between Conducting Polymers and II-VI Semiconductors", Chyan, O.M.R.; Wrighton, M.S., Gordon Research Conference on Photoconductivity, Santa Barbara, California. (1986)
3. "Highly Oxidized and Reduced Electronically Conducting Polymers: Finite Windows of Conductivity", Chyan, O.M.R.; Wrighton, M.S., National Meeting of The Electrochemical Society, Los Angeles, California. (1989)
4. "Direct Imaging of the Layered Transitional Metal Dichalcogenides- TaS<sub>2</sub> and WTe<sub>2</sub>", Chyan, O.M.R.; Hubbard, A.T., National Meeting of the American Vacuum Society, Seattle, Washington. (1991)
5. "Epitaxially Grown SiC Films Studied by ADAM and STM", Chyan, O.M.R.; Hubbard, A.T., National Meeting of American Physical Society, Indianapolis, Indiana. (1992)
6. "Angular Distribution Auger Microscopic Studies of the Layered Transitional Metal Dichalcogenides", Chyan, O.M.R.; Hubbard, A.T., National Meeting of American Physical Society, Indianapolis, Indiana. (1992)
7. "Studies of Single Crystal High Tc Superconductor by Angular Distribution Auger Microscopy", Chyan, O.M.R.; Hubbard, A.T., Central Region Meeting of American Chemical Society, Cincinnati. (1992)
8. "Study of Single-Crystal Bi<sub>2</sub>Sr<sub>2</sub>CaCu<sub>2</sub>O<sub>8</sub> High-Tc Superconductors by Angular Distribution Auger Microscopy", Chyan, O.M.R.; Hubbard, A.T., Science, Engineering, and Technology Seminar (SETS), Houston. (1993)
9. "Structural and Analytical Characterization of Adsorbed Pd/Sn Colloids", Chyan, O.M.R.; Chen, J.J.; Liu, M. 207th National Meeting of the American Chemical Society, San Diego, California. (1994)
10. "Metal Deposition on Hydrogen Passivated Silicon Surfaces", Chyan, O.M.R.; Chen, J.J.; and Chien, H.Y., National Meeting of the Electrochemical Society, San Francisco, California. (1994)
11. "Kinetics and Morphology of Copper Deposition on Hydrogen-Passivated Silicon Surfaces from Dilute HF Solutions", Chyan, O.M.R.; Chien, H.Y.; Sees, J.; Hall, L.; Chen, J.J., Second International Symposium on Ultra-clean Processing of Silicon Surfaces, Brugge, Belgium. (1994)
12. "Electrochemical Aspects of Noble Metals Related to Silicon Wafer Cleaning", Chyan, O.M.R.; Chen, J.J.; Chien, H.Y.; Sees, J.; Hall, L., Second International Symposium on Ultra-clean Processing of Silicon Surfaces, Brugge, Belgium. (1994)

13. "Structural and Catalytic Studies of Adsorbed Pd/Sn Colloids", Chyan, O.M.R.; Chen, J.J.; Liu, M., Southwest Regional Meeting of American Chemical Society, Fort Worth, Texas. (1994)
14. "AFM Characterization of Metal Contaminated Silicon Surfaces", Chyan, O.M.R.; Chen, J.J.; Chien, H.Y.; Wu, J.J. The 46th Pittsburgh Conference on Analytical Chemistry & Applied Spectroscopy (PITTCO'95), New Orleans, Louisiana. (1995) .
15. "Metal Deposition Induced Surface Roughening on Hydrogen Terminated Silicon Wafer Surfaces", Chyan, O.M.R.; Chen, J.J.; Chien, H.Y.; Sees, J.; Hall, L. Materials Research Society 1995 Spring meeting, San Francisco, California. (1995) .
16. "High Surface Area Electrode Materials by Direct Metallization of Porous Substrates", Chyan, O.M.R.; Chen, J.J.; Liu, M.; Richmond, M.G.; Yang, K., Materials Research Society 1995 Spring meeting, San Francisco, California. (1995). .
17. "Interfacial Characterization of Metal Contaminated Silicon Wafer Surfaces", Chyan, O.M.R.; Chen, J.J.; Chien, H.Y.; Wu, J.J.; Sees, J.; Hall, L., The 22nd Annual Conference of the Federation of Analytical Chemistry and Spectroscopy Societies FACSS, 95) meeting, Cincinnati, Ohio. (1995). .
18. "Interfacial Characterization of Discrete Metal Deposition on Silicon Surfaces: Morphologies, Kinetics, Catalysis and Sensor Applications", Chyan, O.M.R.; Gordon Research Conference in Electrochemistry, Ventura, California. (1996). .
19. "Potentiometric Analysis of Silver Ions In The Photographic Developing Solutions", Xu, F.; Chen, L.; Chyan, O.M.R., American Chemical Society Meeting in Miniature, Denton, Texas. (1996) .
20. "Electroless Metal Deposition on Hydrogen Terminated Silicon Surfaces: FTIR and AFM Studies", Chyan, O.M.R.; Chen, J.J.; Wu, J.; Xu, F., 190th National Meeting of the Electrochemical Society, San Antonio, Texas. (1996).
21. "Study of Fluoride Induced Dissimilar Metal Corrosion in a Microelectromechanical System", Chyan, O.M.R.; Prasad, J.; Chen, J.J.; Min, L.; Wu, J., 190th National Meeting of the Electrochemical Society, San Antonio, Texas. (1996) .
22. "Discrete Metal Deposition on Hydrogen Terminated Silicon Surfaces: Kinetics, Morphologies and Sensor Applications", Chyan, O.M.R.; Chen, J.J.; Min, L.; Wu, J., Materials Research Society 1996 Fall meeting, Boston, Massachusetts. (1996) .
23. "Monitoring Metal Contaminations in IC Processing Chemicals by a New Silicon-based Potentiometric Sensor", Chyan, O.M.R.; Chen, J.J.; Wu, J., Materials Research Society 1996 Fall meeting, Boston, Massachusetts. (1996) .
24. "A New Silicon-based Sensor for Detecting Ultra-trace Metal Impurities in IC Processing Chemicals", Chyan, O.M.R.; Chen, J.J., SPIE's 1977 Symposium on Microelectronic Manufacturing. (1997). .
25. "The Mechanism of Discrete Nanometal Deposition on Silicon and Diamond

- Surfaces", Chyan, O.M.R.; Gao, J.S.; Chen, J.J.; Ponnuswamy, T.; Arunagiri, T.N.; Goodwill, P.; Chhim, S.; the American Chemical Society spring national meeting at Dallas, Texas. (1998) .
26. "Detection of Trace Levels of Impurities using a Silicon Based Sensor", Chyan, O.M.R.; Ponnuswamy, T.; Chen, J.J.; Xu, F.; Wu, J.J.; Chen, J.J., the American Chemical Society spring national meeting at Dallas, Texas. (1998) .
  27. "Metal Deposition on Diamond Thin Films", Gao, J., Chyan, O.M.R.; Goodwill, P.; Ponnuswamy, T.; Chen, J.J., the American Chemical Society spring national meeting at Dallas, Texas. (1998) .
  28. "Electrooxidation of HCHO on Pt and Pd Deposited Diamond Thin Films", Arunagiri, T.N.; Chyan, O.M.R.; Gao, J.; Goodwill, P.; the American Chemical Society spring national meeting at Dallas, Texas. (1998) .
  29. "Characterization of Trace Impurities in Ultrapure Chemicals Using a Silicon-based Sensor", Chyan, O.M.R.; Gordon Research Conference in Chemical Sensor and Interfacial Design, Meriden, New Hampshire. (1998) .
  30. "Detection of Ag<sup>+</sup> Ion Utilizing a Silicon Based Potentiometric Sensor", Chyan, O.M.R.; Chen, J.J.; Xu, F.; Gao, J.; Christ, C.S.; the annual meeting of the Society of Environmental Toxicology and Chemistry, Charlotte, North Carolina. (1998) .
  31. "Deposition of Metal Nanoparticles on Diamond Surface via a Solution Route", Chyan, O.M.R.; with Arunagiri, T.N.; Gao, J.; Chen, J.J.; Goodwill, P., the 198th meeting of the Electrochemical Society of Phoenix, Arizona. (2000) .
  32. "Ionic Silver: Discrepancies Among Model Predictions, Measured Concentrations, and *Ceriodaphnia Dubia* Mortality", Brook, B.W.; Chyan, O.M.R.; Peng, H.; Chan, R.; La Point, T.W., the 2000 annual meeting of the Society of Environmental Toxicology and Chemistry, Knoxville, Tennessee. (2000).
  33. "Detection of Trace Impurities in Ultrapure Chemicals Using a Silicon-Based Potentiometric Sensor", Chyan, O.M.R.; Chen, J.J.; Ponnuswamy, P.; Chan, R., the 2000 International Chemical Congress of Pacific Basin Societies (Pacifichem 2000), Honolulu, Hawaii. (2000).
  34. "Silicon-based Chemical Sensor", Chan, R.; Chyan, O.M.R.; Brook, B.W.; Peng, H.; La Point, T.W., the American Association for the Advancement of Science--Southwestern and Rocky Mountain Division's Annual Meeting, Denton, Texas. (2001) .
  35. "Silicon + Conducting polymer", Parikh, K.; Chyan, O.M.R.; the American Association for the Advancement of Science-Southwestern and Rocky Mountain Division's Annual Meeting, Denton, Texas, March. (2001)
  36. "Metal Nanoparticle formation on Diamond", Arunagiri, T.N.; Chyan, O.M.R., the American Association for the Advancement of Science--Southwestern and Rocky Mountain Division's Annual Meeting, Denton, Texas. (2001) .

37. "Investigation of Copper Electrodeposition on Ruthenium Metal Surface", Chyan, O.M.R.; Arunagiri, T.N.; Ponnuswamy, T.; the Materials Research Society Fall meeting, Boston, Massachusetts. (2001) .
38. "Study of Copper Electrodeposition and its Inter-diffusion Properties on Ruthenium Metal Surface", Chyan, O.M.R.; Arunagiri, T.N.; Chan, R.; Ponnuswamy, T.; Hurd, T.; the 201th meeting of the Electrochemical Society, Philadelphia. (2002) .
39. "Electrodeposition of Copper on Ruthenium and Ruthenium Oxide Surfaces and Its Application In Integrated Circuit Fabrication", Chyan, O.M.R.; with Arunagiri, T.N.; Chan, R.; Zhang, Y.; Cheng, C.; Sarik, J.; Hurd, T.; ACS Southwest Regional Meeting, Austin. (2002) .
40. "Interfacial Characterization of Copper Thin Film on Ruthenium: a Potential Diffusion Barrier for Cu Interconnects", Chyan, O.M.R.; Chan, R.; Arunagiri, T.; Zhang, Y.; Hurd, T.; American Vacuum Society Meeting, Santa Clara. (2003) .
41. "Functionalization of Silicon Surface with Acrylonitrile and Organometallic Compounds Studied with ATR-FTIR", Nalla, P., Chyan, O.M.R.; Richmond, M., American Chemical Society Meeting-in-Miniature, Commerce, Texas. (2003).
42. "Interfacial Study of Ru Films by means of the Electrochemical Quartz Crystal Microbalance (EQCM) ", Ojeda, O.; Chyan, O.M.R., American Chemical Society Meeting-in-Miniature, Commerce, Texas. (2003) .
43. "Electrochemistry Cu Deposition on Ruthenium and Ruthenium Oxide Surfaces", Zhang, Y.; Chyan, O.M.R., American Chemical Society Meeting-in-Miniature, Commerce, Texas. (2003) .
44. "Ruthenium-based Copper Diffusion Barrier: Studied by Electrochemistry, SIMS Depth Profiling and Sheet Resistance Measurements", Chyan, O.M.R.; Chan, R.; Arunagiri, T.N.; Wallace, B.; Kim, M.; Hurd, T.; the 204th meeting of the Electrochemical Society, Orlando. (2003) .
45. "Investigation of Oxide Growth on Ruthenium and its Interaction with Copper", Chyan, O.M.R.; with Zhang, Y.; Hunag, L.; Arunagiri, T.N.; Chan, R.; and Wallace, B., the 204th meeting of the Electrochemical Society, Orlando. (2003) .
46. "Surface Characterization and Inter-diffusion Study of Copper on Ruthenium Thin Film Deposited on Silicon Substrate", Chyan, O.M.R.; Arunagiri, T.N.; Chan, R.; Zhang, Y. Wallace, B.; Kim, M.; Hurd, T., American Vacuum Society Meeting, Baltimore. (2003) .
47. "Evaluating Ruthenium Thin Film Deposited on Silicon as a Directly Plate-able Cu Diffusion Barrier", Chyan, O.M.R.; Arunagiri, with Hurd, T.; Wallace, B.; Kim, M.; Chan, R.; Arunagiri, T.N., American Vacuum Society Meeting, Baltimore. (2003) .
48. "Ultrathin Ruthenium Film as a Direct Plate-able Seedless Cu Diffusion Barrier for Sub 65 nm Node Integrated Circuits Application", Arunagiri, T.N.; Zhang, Y., Nalla, P.; Ojeda, O.; Flores, S., Chyan, O.M.R., the Metroplex Research Consortium for Electronic Devices and Materials, Denton, Texas. (2004) .
49. "Interfacial Electrochemistry of Cu on Ru and Ru Oxide surfaces and its Application to

- Cu Metal Interconnects.", Ojeda, O.; Flores, S.; Arunagiri, T.N.; Zhang Y.; Chyan, O.M.R., the Metroplex Research Consortium for Electronic Devices and Materials, Denton, Texas. (2004) .
50. "Ruthenium: a Promisingly New Diffusion Barrier for Copper Interconnects for 65 and 45 nm Integrated Circuits Technology Nodes", Arunagiri, T.N.; Misra, A.; Chyan, O.M.R., the International Convention on Surface Engineering, INCOSURF-2004, Bangalore, India. (2004) .
  51. "Stability of RuO<sub>2</sub>/Cu/RuO<sub>2</sub> structure: Cu diffusion study", Lim, C. D.; Ukirde, V.; Walker, E.; Chyan, O.M.R.; M. El. Bouanani, 18th International Conference on the Application of Accelerators in Research and Industry, Forth Worth, Texas. (2004)
  52. "Bimetallic Corrosion at Dissimilar Metal Interfaces in Cu Interconnect Microstructure", Chyan, O.M.R.; Nalla, P.; Arunagiri, T.N., Semiconductor Research Corporation. (2004)
  53. "Investigation of Electrochemical Copper Patination: pH Effect and iodine Adsorption" with Venkataraman, S.; Chyan, O.M.R.; American Chemical Society Meeting-in-Miniature, Arlington, Texas. (2005) .
  54. "Metallization of Surface Silicon Using Dinuclear Ruthenium Carbonyl Compounds and Metal Clusters. Anchoring of Ruthenium to a Si(111) Surface Through Covalent Ru-Si Bond Formation to give Monolayer Composition", Nalla, P.; Huang, S.; Zhang, Y.; Chyan, O.M.R.; Richmond, M.G., El Bouanani, M., American Chemical Society Meeting-in-Miniature, Arlington, Texas. (2005)
  55. "Electrodeposition of Cu on Ru and Ru Oxide Ultra-thin Films and its Application to Cu Interconnects", Chyan, O.M.R.; Arunagiri, T.N.; Zhang, Y.; Ojeda, O.; Flores, S.; Nalla, P., the 207th meeting of the Electrochemical Society, Quebec City. (2005) .
  56. "Interfacial Characterization of Electrodeposited Cu on 5-10 nm Ru Films Supported by Low-k Dielectrics", Nalla, P.; Chyan, O.M.R.; Arunagiri, T.N., the 207th meeting of the Electrochemical Society, Quebec City. (2005) .
  57. "PVD vs. ECD Copper Diffusion and Interfacial Stability Studies Across a 5 nm Ruthenium Film Deposited on Silicon", Chyan, O.M.R.; Arunagiri, T.N.; Zhang, Y.; the 207th meeting of the Electrochemical Society, Quebec City. (2005) .
  58. "Arrayed Nanocomposites grown on TiSi<sub>2</sub>-buffered Si for Electrochemical Energy Generation and Storage Applications", Sun L.; Fang, W.; Chyan, O.M.R.; Chen, K.; Chen, L., the 56<sup>th</sup> Annual Meeting of the International Society of Electrochemistry, Busan, Korea. (2005)
  59. "Ru Enhanced Copper Corrosion in Ammonium Citrate Solution- A New Challenge for Cu CMP in Cu/Ru Structure", Nalla, P.; Chyan, O.M.R.; TECHCON 2005, Semiconductor Research Corporation, Portland, Oregon. (2005).
  60. " Analytical TEM characterization of metal penetration and supercritical pore-sealing of ash-damaged porous low-k dielectrics" Gorman, B. P.; Mueller, D. W.; Chyan, O.; Reidy, R. F; Advanced Metallization Conference AMC 2005, Colorado Springs, CO,

61. "Surface Oxide Formation on Ru and its Effect on Copper Electrodeposition", Chyan, O.M.R.; Venkataraman, S.; Yu, K.; the 208th meeting of the Electrochemical Society, Los Angeles. (2006)
62. "Investigation of Electrochemical Copper Patination: Effects of pH and Iodine Adsorption Studies", Venkataraman, S.; Chyan, O.M.R., the 208th meeting of the Electrochemical Society, Los Angeles. (2006)
63. "Enhanced electrochemical properties of micro-energy devices based on arrayed carbon nanotubes and their composites with Pt-Ru or RuOx nanoparticles" Wang, C.H., Fang W.C., Shih H.C., Huang, J.H., Tsai, Y.T., Du, H.Y., Chen, L.C., Sun, C.L., Chen, K. H., Papakonstantinou, P., Chyan, O; Diamond 2006, Estoril, Portugal (2006).
64. "Investigation of Electrochemical Copper Patination on Noble Metal Surfaces", Y. Zhang, Venkataraman, S.; Chyan, O.M.R., , 231th American Chemical Society National Meeting, Atlanta, Georgia. (2006).
65. "Metal Electroplating on an Integrated Screen-Printed Electrode Assembly – New Approach to Teach Faraday's Law", Chyan, O.M.R, Chyan, Y; ACS Southwest Regional Meeting, Houston. (2006)
66. " Developing a Rapid Screening Metrology for Cu Corrosion in CMP Relevant Chemical Environments", Chyan, O.M.R.; Yu, K. K. , *International Conference on Planarization/CMP Technology*, Taiwan (2008)
67. " Electrochemical Investigation of Cu Corrosion in Cu-CMP and Post-CMP Solution Environments", Yu, K.; Chyan, O.M.R.; TECHCON 2008, University of Texas, Austin, Texas. (2008).
68. " Photoelectrochemical Property Improvement of GaN Thin Film Through Etching ", A. Basilio, H. Yu-Kuei, T. Wen-Hsun, Y. Cheng-Hsuing, H. Geng-Ming, C. Oliver Chyan, Li-Chyong and C. Kuei-Hsie, the 216th ECS Meeting in Vienna, Austria. October (2009).
69. "Study of Bimetallic Corrosion Related to Cu Interconnects by Using Micropattern Corrosion Screening and Tafel Plots" Yu, K.; Chyan, O.M.R.; ACS Miniature meeting, Denton, (2009).
70. "Investigation of Cu Bimetallic Corrosion in CMP Chemical Environments using Micropattern Corrosion Screening", Nalla, P.; K. Pillai; Yu, K.; Venkataraman, S.; Chyan, O.M.R., *Advanced Metallization Conference*, Baltimore, (2009).
71. "Study of Cu Corrosion in Polyphenols Anti-oxidants Solution", Yu, K.; Chyan, O.M.R., Semiconductor Research Corporation / Center for Advanced Interconnect Science and Technology program Review, Albany, New York. (Oct 2009)
72. " Preparation and Characterization of Ru-Ta Alloys and Study of Electrochemical Cu Deposition", Pillai, K.S.; Chyan, O.M.R., Semiconductor Research Corporation / Center for Advanced Interconnect Science and Technology program Review, Albany, New York. (Oct 2009)
73. " Effect of Plasma Etch Chemistry to the Cu Bimetallic Corrosion in Cu Interconnect

- Structure ", Yu, K.; Pillai, K.S.; Chyan, O.M.R., Semiconductor Research Corporation / Center for Electronic Material Processing and Integration program Review, UNT, Denton. (Nov 2010)
74. " Synthesis of High-Quality Graphene Monolayer by Thermal Chemical Vapor Deposition", Abdelghani, J.; Koskey, S.; Chyan, O.M.R.; ACS Southwest Regional Meeting, Austin. (2011)
  75. " Electrochemical quartz crystal microbalance and X-ray photoelectron spectroscopy study of bismuth underpotential deposition on ruthenium ", Lin, P.F.; Abdelghani, J.; Taylor, D.; Chyan, O.M.R.; ACS Southwest Regional Meeting, Austin. (2011)
  76. "Study of Cu bimetallic corrosion in CMP chemical environments using optical scanning and micropattern corrosion screening" Yu, K. K.; Thomas, N.; Venkataraman, . S.; Pillai, K. S. M.; Hurd, T. Q.; Boggs, K.; Chyan, O.M.R.; the 219th ECS Meeting in Montreal. (2011)
  77. "Cu Electrodeposition on Ru-Ta Alloy Thin Films" Pillai, K.S.M.; Yu, K.K.; Chyan, O.M.R.; the 219th ECS Meeting in Montreal. (2011)
  78. " EQCM Investigation of Metal Deposition on Ru and Ru Oxide Surfaces ", Yu, K.K. ; Lin, P. ; Abdelghani, J.; Venkataraman, S.S.; Chyan, O.M.R.; the 220th ECS Meeting in Boston. (2011)
  79. " Characterization of Post Etch Residues on Patterned Porous Low-k using Multiple Internal Reflection Infrared Spectroscopy " Rimal, S.; Ross, N.; Pillai, K. S.M.; Singh, K.J., Chyan, O.M.R.; the 220th ECS Meeting in Boston. (2011).
  80. " Visualization of Surface Energy Topography on Large-scaled Graphene by Electrochemical Approach" Lin, Y.K.; Chyan, O.M.R.; Chang, C.K.; Chen, Y.F.; Chen, L.C.; Chen, K.H.; New Diamond and Nano Carbons Conference, Singapore. (2013).
  81. "Towards a Faster Computer-How Chemistry Can Help", Mukherjee, T. and. Chyan, O.M.R., UNT Graduate Exhibition, Denton (2013).
  82. "Characterization of Boron Doped Amorphous Silicon Films by Multiple Internal Reflection Infrared Spectroscopy", N. Ross, K. Shrestha, O. Chyan, C. L. Littler, V. C. Lopes, and A. J. Syllaios, Mater. Res. Soc. International Meeting, San Francisco. (2013).
  83. "Bonding structure characterization and UV-assisted wet removal of fluorocarbon polymer film on low-k dielectric trench structure", Mukherjee, T.; Berhe, S.A.; Arindom Goswami, A.; Chyan, O. M.R., ACS Southwest Regional Meeting, Dallas. (2014)
  84. "Probing Si-OH and Si-CH<sub>3</sub> of Plasma Damaged Low-k Dielectric Nanostructures by MIR-IR Spectroscopy", Rimal, S.; Chyan, O. M.R., ACS Southwest Regional Meeting, Dallas. (2014)
  85. "Spectroscopic Study of the Chemical Bonding Structure in Amorphous Silicon for Microbolometer IR Imaging Application", Ross, N.; Chyan, O. M.R., ACS Southwest Regional Meeting, Dallas. (2014)

86. "Study of Cu Bimetallic Corrosion and its Inhibition Strategy for Cu Interconnect Application using Micro-pattern Corrosion Screening " Goswami, A.; Koskey, S.; Yu, K.; Chyan, O.M.R.; the 227th ECS Meeting in Chicago. (2015).
87. "Exploration of Chemical Bonding Transformation Mapping to Assist Low-k Dielectric Nanostructure Fabrication " Chyan, O.M.R.; Rimal, S.; Mukherjee, Goswami, A.; Ross, N.; the 227th ECS Meeting in Chicago. (2015)
88. "Study of Bimetallic Corrosion and Its Inhibition Strategy for Cu Interconnect and IC Packaging Using Micro-Pattern Corrosion Screening" Ross N.; Goswami, A.; Berhe, S.A.; Lin, P. ; Snitker, J.; Chyan, O.M.R.; SRC *TECHCON 2015*, Austin, Texas.
89. " Micro-pattern Corrosion Screening on Bimetallic Corrosion for Microelectronic Application" Chyan, O.M.R.; Yu, K.; Nalla, P.; Koskey, S.; the 66th ISE Annual Meeting in Taipei, Taiwan. (2015)
90. " Aluminum Bonding Pad Corrosion of Wirebond Packages " Mathew, V.; Chopin, S.; Chyan, O.M.R.; Ross, N.; Lambert, A.; Asokan, M.; IMAPS-2016, Pasadena, CA. (2016)
91. "Optimization of Cupric Chloride Chemical Equilibrium for Subtractive Etching of High Density Interconnects " Lambert, A.; Asokan, M.; Hix, M.; Casey, L.; Ashok Kumar, G. I.; Chyan, O.; Ojeda, O.; Ecton, J.; Roy, A.; Wang, H.; Arana, L., IPC-APEX 2017, San Diego, CA. (2017)
92. "Mechanistic Investigation and Prevention of Al Bond Pad Corrosion in Cu Wire Bonded Device Assembly" A. Lambert, M. Asokan, N. Ross, S. Berhe, O.M.R., Chyan, M. Chowdhury, S. O'Connor, L. Nguyen, ECTC-2017, Lake Buena Vista, FL. (2017)
93. "Aluminum Bond Pad Corrosion in Copper Wire Bonded Assembly – Defectivity characterization and Prevention Strategy" Chyan, O.M.R.; Asokan, M.; Berhe, S., Chowdhury, M.; Connor, S.O.; Nguyen, L., *TECHCON*, Austin, Texas, (2017).
94. "Novel Corrosion Prevention Treatments for Cu Wire Bonded Device to Improve Bonding Reliability " M. Asokan, J. Caperton, Z. Thompson, O. Chyan, M. Chowdhury, S. O'Connor, L. Nguyen, ECTC-2017, San Diego, CA (2017)
95. "Characterization of Post-etch Residue Clean By Chemical Bonding Transformation Mapping", M. Asokan, C.H, Wu, C.C. Shih, T.C. Chang, O. Chyan; The Surface Preparation and Cleaning Conference (SPCC) at Boston, MA (2018)
96. " Optimization of Cupric Chloride Subtractive Etching for Cu High Density Interconnects " Lambert, A.; Ashok Kumar, G. I.; Salunke, A, Lu, L.; Chyan, O.M.R.; Ojeda, O.; Ecton, J.; Roy, A.; Wang, H.; Arana, L., International Microelectronics Assembly and Packaging Society Meeting, IMAPS-2018, Pasadena, CA (2018).
97. " Explore High Bonding Reliability of Cu Wire Bonded Devices under Extreme Halide Contaminated Environments " Chyan, O.M.R.; Asokan, M.; Caperton, A.; Salunke, A.; Xu, F.; International Microelectronics Assembly and Packaging Society, IMAPS-2018 , Pasadena, CA (2018).
98. "Comparative study of Chloride and Fluoride induced Al pad corrosion in wire bonded

- packaging assembly", Ashok Kumar, G. I.; Lambert, A.; Caperton, J.; Asokan, M.; Yi, W.; Chyan, O.; the 51st ACS MiM, Dallas (2018)
99. "Spectroscopic Investigation of Complex Redox Equilibria in Cupric Chloride Subtractive Etching for Cu High Density Interconnects", Ashok Kumar, G. I., Lambert, A.; Caperton, J.; Salunke, A.; Lu, L.; and Chyan, O. 235th ECS Meeting, Dallas (2019)
  100. "Comparative study of Chloride and Fluoride induced Al pad corrosion in wire bonded packaging assembly", Ashok Kumar, G. I.; Lambert, A.; Caperton, J.; Asokan, M.; Yi, W.; Chyan, O.; 235th ECS Meeting, Dallas (2019)
  101. "Development of a New Copper Corrosion Screening Methodology for Application in Microelectronics" Alptekin, J.; Salunke, A. S.; Asokan, M.; Ashok Kumar, G. I.; Caperton, J.; and Chyan, O.; 235th ECS Meeting, Dallas (2019)
  102. Skinner, E.; Caperton, J.; Chyan, O. "UV light modulation of copper etching" Mississippi Local Section of the American Chemical Society Awards Banquet and Poster Competition (2019)
  103. Skinner, E.; Caperton, J.; Chyan, O. "UV light modulation of copper etching." 52nd Annual Southeastern Undergraduate Research Conference, Tuscaloosa, AL (2020)
  104. "MIR-IR Wafer Characterization Metrology Operational Demonstration" J. Caperton,; Salunke, A. S.; Alptekin, J.; and Chyan, O.; Intel, Oregon (2020)
  105. "Novel CVD Strategy for IC Packaging Corrosion Prevention" Asokan, M and Chyan, O.; Intel, Oregon (2020)
  106. "Optimization of Corrosion Prevention Treatments for Cu Wire- Bonded Devices to Achieve High Bonding Reliability", Ashok Kumar, G. I. and Chyan, O.; Intel, Oregon (2021)
  107. "Cu Etch Bath Chemistry Investigation for High-Density Interconnects and FTIR Metrology Development for Si Thin Film Characterization" J. Caperton and Chyan, O.; Intel, Oregon (2021)
  108. "Enabling the Next Generation of High Reliability Electronics Utilizing Foundational Chemistry Knowledge", Alptekin, J. and Chyan, O.; the ACS MiM, Dallas (2022)
  109. " Investigation of CuAl IMCs Corrosion in Chloride Environment and its Prevention Strategy" Alptekin, J.; Gopalakrishnan, E.; Kumaravel D.; Antony K.; Chyan, O.M.R.; Varughese Mathew, V., *International Microelectronics Assembly and Packaging Society*, IMAPS-2022 Boston (2022)
  110. "Prevention of Cu Electrolytic Migration Defects on RDL by a Cu-selective Passivation to Enhance Reliability " Salunke, A.; Akula, K.; Jayakumar, S.; Kumar, S.; Alptekin, J.; Chyan, O.M.R., *International Microelectronics Assembly and Packaging Society*, IMAPS-2022 Boston (2022)
  111. " Real Time Screening of Cu/Al Bimetallic Corrosion Defects: Application in Integrated Circuit Packaging Device" Alptekin, J.; Gopalakrishnan, E.; Kumaravel D.; Antony K.; Chyan, O.M.R.; ACS-2022 Chicago (2022)
  112. "Optimization of Corrosion Prevention Treatments for Cu Wire- Bonded Devices to Achieve High Bonding Reliability" Alptekin, J.; Chyan, O.M.R.; TI (2022)

113. "Analyzing Interfacial Copper Migration on Microelectronic Devices with Organic Chemical Coatings" Akula, K.; Salunke, A.; Chyan, O.M.R., *UNT Honor Day Presentation*, (2022)
114. " Electrochemical Investigation of Al Bond Pad Corrosion and Prevention for IC Packaging Application” Langerak, H.; Alptekin, J.; Kumaravel D.; Antony K.; Salunke, A.; Chyan, O.M.R.; ACS-2022 Chicago (2022)
115. "Exploration of Cu Surface Chemistry Modification to Eradicate Corrosion Defect in IC Packaging", Kumaravel, D. K. and Chyan, O.; the ACS MiM, Tarleton State University (2023)
116. "Tunable Low-cost Passivation Coating for Facilitating Copper Wafer-level Bonding” Antony, K.; Kumaravel, D.; Chyan, O.M.R.; SRC packaging program review, Purdue University, West Lafayette, Indiana (2023)
117. "Tunable Thermal Conductivity, Dielectric Strength Bio-based Molding Compounds, and Die-Attach Adhesives” Gurrarn, P.; Gundala, K.; Nair, S.; Nair, S.; Chyan, O.M.R.; D’Souza, A.; SRC packaging program review, Purdue University, West Lafayette, Indiana (2023)
118. "Exploration of Cu-Cu Wire Bonding Facilitated by Passivation Coating to Enhance Packaging Reliability" Antony Jesu Durai, K.; Kumaravel, D. K.; Alptekin, J.; Estridge, L.; Chyan, O.M.R., *International Microelectronics Assembly and Packaging Society, IMAPS-2023 San Diego* (2023)
119. "Corrosion Protection Strategies of Cu-Al Wire-bonded Devices in Ion-rich Environments" Kailey Yu; Chyan, O.M.R., *UNT Scholar Day Poster Presentation*, Denton (2024)
120. "Reducing the defects of 2D Transition Metal Dichalcogenides to Improve Transistor Performance" Shree Mishra; Chyan, O.M.R., *TAMS Science Fair*, UNT, Denton (2024)
121. "Enhancing Cu Wire-Bonding Reliability by a Cu-Selective Passivation Coating" Kumaravel, D. K.; Antony Jesu Durai, K.; Alptekin, J.; Nair, S.; Chyan, O.M.R.; Mathew, V. *IEEE Electronic Components and Technology Conference, ECTC-2024*. Denver.
122. "Tunable Low-cost Passivation Coating for Facilitating Copper Wafer-level Bonding” Antony, K.; Kumaravel, D.; Chyan, O.M.R.; SRC packaging program review, Intel, Chandler, Arizona (2024)
123. "Tunable Thermal Conductivity, Dielectric Strength Bio-based Molding Compounds, and Die-Attach Adhesives” Gurrarn, P.; Gundala, K.; Nair, S.; Nair, S.; Chyan, O.M.R.; D’Souza, A.; SRC packaging program review, Intel, Chandler, Arizona (2024)
124. "Exploring Deep Eutectic Solvents as Environmentally Benign Post-etch Residue Removers” Sapkota, B.; Antony, K.; Kumaravel, D.; Nair, S.; Yan, H.; Chyan, O.M.R.; SRC packaging program review, Intel, Chandler, Arizona (2024)
125. "Interaction Mechanisms of 2D Materials with FEOL Wet Cleans” Rupom, R.; Nair, S.; Nair, S.; Choi, W.; Chyan, O.M.R.; SRC packaging program review, Intel, Hillsboro, Oregon (2024)
126. "Innovative Cu-Selective Passivation Coatings for Enhanced Reliability in Cu Interconnects for IC Packaging" Kumaravel, D. K.; Antony Jesu Durai, K.; Nair, S.; Tran, K.T.A.; Chyan, O.M.R.; Ramarao Poliah, R.; Chan, M. Z.; Mathew, V. *IEEE 26th Electronics Packaging Technology Conference, EPTC-2024*. Singapore. (2024)

127. "Reducing the defects of 2D Transition Metal Dichalcogenides to Improve Transistor Performance" Mishra, S.; Sridharan, S.; Chyan, O.M.R., UNT TAMS Fair, (2024)
128. "Advanced Characterization of Transition Metal Dichalcogenides and their Wet Cleaning Interactions for High Efficiency Transistor Fabrication" Mishra, S.; Sridharan, S.; Chyan, O.M.R., UNT Scholars Day Presentation, (2025)
129. "Development of an Aluminum-Selective Coating Methodology for Corrosion Mitigation in Wire-Bonded Devices" Ahluwalia, P.; Nair, S. S.; Kumaravel, D.K; Tran, K.; Chyan, O.M.R., UNT Scholars Day Presentation, (2025)
130. "Development of a New Passivation Coating to Improve IC Packaging Reliability: A Pilot Trial Report " Kumaravel, D. K.; Nair, S.; Chyan, O.M.R.; Ramarao Poliah, R.; Chan, M. Z.; Mathew, V. *IMAPS Wire Bonding Workshop, San Diego. (2025)*
131. "Anticorrosive Strategies for Cu-Al Wire-Bonded Devices in Extreme Automotive Applications" Pavan Ahluwalia, Kumaravel, D. K; Chyan, O.M.R.; *The Fort Worth Regional Science Fair. (2025)*
132. "Advanced Characterization of Transition Metal Dichalcogenides and their Wet Cleaning Interactions for High Efficiency Transistor Fabrication" Mishra, S.; Nair, S. S.; Chyan, O.M.R.; *The Fort Worth Regional Science Fair. (2025)*
133. "Anticorrosive Strategies for Cu-Al Wire-Bonded Devices in Extreme Automotive Applications" Pavan A.; Kumaravel, D. K; Chyan, O.M.R.; *Texas State Science & Engineering Fair. (2025)*
134. "Enhancing Wafer-Level Cu-Solder Bonding: A Fluxless Approach with Cu-Selective Passivation Coating" Antony Jesu Durai, K.; Kumaravel, D. K.; Nair, S.; Tran, K.T.A.; Chyan, O.M.R.; *IEEE Electronic Components and Technology Conference, ECTC-2025 Dallas. (2025)*
135. "Anticorrosive Strategies for Cu-Al Wire-Bonded Devices in Extreme Automotive Applications" Pavan A.; Kumaravel, D. K; Chyan, O.M.R.; *ACS Meeting in Miniature. (2025)*
136. "Exploration of Cu Interfacial Engineering to Enhance Cu Interconnects Reliability" Antony Jesu Durai, K.; Kumaravel, D. K.; Nair, S.; Tran, K.T.A.; Nair, S. S., Chyan, O.M.R.; *IEEE European Microelectronics & Packaging Conference , EMPC-2025 Grenoble, France (2025)*
137. "Facilitating High-Reliability Cu-to-Cu Direct Bonding via Tunable Cu-selective Oxide suppression Coating for Advanced Interconnects" Antony Jesu Durai, K.; Kumaravel, D. K.; Tran, K.T.; A.; Perera, D. A. S.; Chen, H. C.; Chiu, P. W.; Chen, K.H.; Chyan, O.M.R., *International Microelectronics Assembly and Packaging Society, IMAPS-2025, San Diego. (2025)*
138. " Copper Interfacial Engineering for Oxide-Suppressed, Fluxless Cu-Solder and Cu-to-Cu Thermocompression Bonding" Antony Jesu Durai, K.; Kumaravel, D. K.; Tran, K.T.; A.; Perera, D. A. S.; Chyan, O.M.R., *IEEE International Microsystem, Packaging, Assembly and Circuit Technology Conference (IMPACT 2025), Taipei, Taiwan (2025)*

139. " Investigating Bimetallic Corrosion and Reliability in Palladium Coated Copper Wire Bonded Systems" Chyan, O.M.R., Nair, S.M. ; Tran, K.T.A.; Nair, S. S., *76th Annual Meeting of the International Society of Electrochemistry*, Mainz, Germany (2025)
140. "Process-Compatible Wet Cleaning and Characterization of MoS<sub>2</sub> Thin Films for Advanced Transistor Nodes," Nair, S. S.; Rupom, R. H.; Perera, D. A. S.; Mishra, S.; Auluck, G.; Michaelos, T.; Kozhakhmetov, A.; Maxey, K.; Chyan, O.M.R; Choi, W., *SRC TECHCON 2025*, Austin, TX. (2025).
141. "Metrology Advancements and Wet Cleans of 2D TMDs for Next-generation Transistor Applications", Nair, S. S.; Rupom, R. H.; Perera, D. A. S.; Chyan, O.M.R.; Choi, W. *SRC NMP program review*, University of Texas, Dallas, TX. (2025)
142. "Exploring Deep Eutectic Solvents as Environmentally Benign Post-etch Residue Removers", Sapkota, B.; Yan, H.; Kumaravel, D.; Antony Jesu Durai, K.; Chyan, O.M.R.; Choi, W. *SRC NMP program review*, University of Texas, Dallas, TX. (2025)
143. " Investigation of Cu-Cu Stitch Bonding Reliability on Cu Leadframe Substrate Using Ultrathin Cu-Selective Passivation" Nair, S.M.; Perera, D. A. S.; Farmer, G.; Abraham, J.; Tran, K.T.A.; Philipose, U.; Chyan, O.M.R., *International Microelectronics Assembly and Packaging Society Meeting, IMAPS-2025*, San Diego. (2025)

## Teaching

CHEM 5460	Modern Aspects of Analytical Chemistry (Graduate, 1996-current)
CHEM 4551	Quantitative Analysis (Undergraduate, 1998-curent)
CHEM 4552	Quantitative Analysis Lab (Undergraduate, 1998-current)
CHEM 3610	Quantitative Techniques (Undergraduate, 1999, 2002)
CHEM 5570	Advanced Analytical Chemistry (Graduate, 1996, 2025)
CHEM 5390	Microelectronic Materials Chemistry (Graduate, 2003)
CHEM 5390	Applied Electrochemistry (Graduate, 2001)
CHEM 5390	Interfacial Electrochemistry (Graduate, 1995, 1997)
CHEM 1410	General Chemistry (Undergraduate, 1992-1995)

## Teaching Philosophy and Goals

**1) CHEM 6950 Graduate Dissertation:** Graduate students mentored by Professor Chyan at his Interfacial Electrochemistry and Materials Research Laboratory conducted interdisciplinary research with strong collaboration with microelectronic industry, to investigate multitude of fundamental and applied research projects relevant to advanced microelectronic fabrication and integration, semiconductor materials chemistry and interfacial electrochemistry. The active collaboration between UNT and microelectronic industry collaborators offers highly marketable education/research training to students. PI's Students often received high-tech job offers before

they graduated. So far, >85% of 20 Ph.D and 11 M.S. graduated from PI's group enjoyed successful employment in microelectronic related industry.

**2) CHEM 3451, 3452 Quantitative Analysis and QA Lab:** The goal of these two courses emphasize on the quantitative aspects of the basic analytical chemistry. The accompanying lab works is designed to sharpen students' hand-on operation skills in field of quantitative analysis. The course includes statistical treatment of data, sampling and transfer techniques, gravimetric and volumetric methods and introductory instrumental analysis.

**3) CHEM 5460 Modern Analytical Chemistry:** My goal for the CHEM 5460 was to strengthen the students' background knowledge on an advanced graduate level of analytical chemistry. Accordingly, the course was designed to survey the modern analytical methods with emphasis on instrumental techniques and data handling, including separation methods, electrochemical methods, spectroscopy, AI-empowered Analytical Chemistry in real-world applications. I have also included many practical interdisciplinary applications in the lecture to broaden students' view on the industrial problems.

### Supervised Students Achievements

- **Shinoj Nair received offer for 2026 internships at TEL Technology center at Austin Texas.**
- **Pavan Ahluwalia received UNT nomination for the 2026 Barry Goldwater Scholarship Application and awarded TAMS Dean's Scholarship.**
- **Pavan Ahluwalia, 1st place, Materials Science, Texas Science and Engineering Fair (Mar 2025)**
- **Pavan Ahluwalia, 1st place, Chemistry, Fort Worth Regional Science and Engineering Fair (Feb 2025)**
- **Pavan Ahluwalia (3<sup>rd</sup> place, presentation in Materials Science section, ACS miniature, 2025)**
- **Shyam Nair received offer for 2026 Intel summer internship.**
- **Kevin Antony, Dinesh Kumaravel – successful 2025 summer internships at TEL Technology center at Albany NY.**
- **Kevin Antony, co-authored in journal Nature, successfully utilized IEMR Ultrasensitive IR metrology to work with Professor Kui Tan and team to achieve critical chemical bonding characterization.**
- **Kevin Antony, Ed & Julia Hodges Memorial Scholarship, UNT Chemistry Department, 2025**
- **Kevin Antony and co-authors awarded the Best Paper at the 58<sup>th</sup> International *Microelectronics Assembly and Packaging Society* (IMAPS) Conference in San Diego, 2025.**
- **Kevin Antony, 1<sup>st</sup> place, UNT Third Year Graduate Research Talk, 2025**
- **Dinesh Kumaravel, 1<sup>st</sup> place, UNT Third Year Graduate Research Talk, 2025**

- **Texas State Science & Engineering Fair winners (TAMS): Pavan Ahluwalia (1st place) and Exxon Mobil Special Award in Materials Science, 2025**
- **Kevin Antony and co-authors, selected as the 2024 Outstanding Paper published in the Journal of Microelectronics and Electronic Packaging. “Exploration of Interfacial Materials Chemistry Control to Improve Cu Wire-Bonding Reliability” 2024, 21 (2): 42–49.**
- **Dinesh Kumaravel, IEEE-Packaging Society Travel Award, \$2,100, 2024**
- **Dinesh Kumaravel, UNT Toulouse Graduate School Research Award, \$1,000, 2024**
- **Dinesh Kumaravel, UNT International Travel Award, \$500, 2024**
- **Dinesh Kumaravel, UNT College of Science Travel Award, \$500, 2024**
- **Dinesh Kumaravel, UNT Toulouse Graduate School Travel Award, \$500, 2024**
- **Hailey Yu, TAMS, accepted to Emory University**
- **Shree Mishra (3<sup>rd</sup> place, TAMS Science Fair, UNT, 2024)**
- **Kevin Antony Jesu Durai, Ashish S. Salunke (Ph.D. 2022), Dinesh K. Kumaravel, Co-inventors of technology “Cu-Selective Passivation Coating for Copper Pillar Solder Bonding Application” *UNT Invention Disclosure*, 2023.**
- **Dinesh Kumaravel, awarded with Graduate Research Experiences Abroad Travel Grant (GREAT Grant), \$4500, to do research work in Singapore. 2023**
- **Dinesh Kumaravel (3<sup>rd</sup> place, talk in Materials science section, ACS miniature, 2023)**
- **John Alptekin, UNT Great Grad award, 2023**
- **Issac Goutham Ashok Kumar (Ph.D. 2021), John Alptekin (Ph.D. 2023) Co-inventors of a Patent application "Passivation Coating on Copper Metal Surface for Copper Wire Bonding Application",. *United States Patent Application, UNTP.P0037US.P1/1001200335, 2022***
- **John Alptekin (1<sup>st</sup> place, in Materials science section, ACS miniature) (1<sup>st</sup> place 3<sup>rd</sup> years departmental talk) 2022**
- **Dr. Kyle Kai-Hung Yu (Ph.D. 2011), promotion to Member of Technical Staff, Sr. Manager of Thin Film Fabrication, Tokyo Electron Ltd., 2022**
- **Ashish S. Salunke (Ph.D. 2022), won the second place Graduate Research Presenter in the 2020 Graduate Student Seminar Day.**
- **Issac Goutham Ashok Kumar (Ph.D. 2021), won the second place Graduate Research Presenter in the 2020 Graduate Student Seminar Day.**
- **Dr. Trace Q. Hurd (Ph.D. 2006), promotion to the Sr. Director of Technology Development, Tokyo Electron Ltd. 2021**
- **Issac Goutham Ashok Kumar (Ph.D. 2021),: Co-inventor of a Passivation Coating on Copper Metal Surface for Copper Wire Bonding Application . *UNT Invention Disclosure, 2021.***
- **John Alptekin (Ph.D. 2023): Co-inventor of a Passivation Coating on Copper Metal Surface for Copper Wire Bonding Application. *UNT Invention Disclosure, 2021.***
- **Dr. Trace Q. Hurd (2006), The Graduate Council Dissertation Award for Research Achievement in the Natural Sciences and Mathematics. Dissertation Title: "*Chemistry,***

*Detection, and Control of Metals During Silicon Processing"*

- **Muthappan Asokan (Ph.D. 2019, expected) won the Best Paper awards** at the 2018 SRC sponsored TECHCON Conference. Presentation Title: “*Mechanistic Investigation and Prevention of Al Bond Pad Corrosion in Cu Wire-bonded Device Assembly*”
- **Dr. Nick Ross (Ph.D. 2017) won the Best Paper awards** at the 2016 SRC sponsored TECHCON Conference. Presentation Title: “*Study of bimetallic corrosion and its inhibition strategy for Cu interconnect and IC packaging using micro-pattern corrosion screening*”
- **Dr. Thomas Ponnuswamy (Ph.D. 2002), promotion to the Director of Technology, LAM Research Inc. 2014**
- **Dr. Praveen Nalla (Ph.D. 2005) won the Best Paper awards** at the 2005 SRC sponsored TECHCON Conference. Presentation Title: “*Ru Enhanced Copper Corrosion in Ammonium Citrate Solution- A New Challenge for Cu CMP in Cu/Ru Structure*”
- **Muthappan Asokan: Co-inventor** of a novel chemical vapor deposition of corrosion prevention treatment. *U.S. Provisional Patent 62/897942, 2019.*
- **Dr. Nick Ross: Co-inventor** of a novel Cu Ball bonding corrosion prevention technology. *U.S. Provisional Patent 62/511,863, 2017.*
- **Alexander S. Lambert: Co-inventor** of a novel Cu bath monitoring technology. *U.S. Provisional Patent 62/432,115, 2016*
- **Dr. Nick Ross (Ph.D. 2017) hired as a “Senior Engineer”** position at Intel right after graduate from UNT with Ph.D.
- **Outstanding Graduate Research awards:** (JunJun Wu, 1996; Tana Arunagiri, 2002; Yibin Zhang 2003; Shyam Venkataraman, 2006).
- **Awards for outstanding talks** at the ACS Regional Meetings (JunJun Wu, 1996; Raymond Chan, 2000; Tana Arunagiri, 2002; Praveen Nalla, 2004; Tamal Mukherjee, 2015; Muthappan Asokan, 2017; Ashok Kumar, G. I., 2018)
- **9<sup>TH</sup> place Nationwide Westinghouse Science Talent Search** (Patrick Goodwill, 1998)
- **Barry W. Goldwater Scholarship Awards** (Patrick Goodwill, 1998; Vivian Liang, 2002).
- **Semi-finalists, Intel Science Talent Search** (Ketul Parikh, 2001; Vivian Liang, 2002)
- **Semi-finalists, Siemens-Westinghouse Science & Technology Competition** (William Ikerd, 1994; Ketul Parikh, 2001; Vivian Liang, 2002; Joe Chen, 2004).
- **Front-cover Research papers** in the American Journal of Undergraduate Research (Vivian Liang, 2002; Chris Chen, 2003).

## Students and Postdoc Advising

### 1) Postdoc Advised

Dr. Jin-song Gao	1998-1999
Dr. Tana Arunagiri	2004-2005
Dr. Seare Berhe	2015-2016

## 2) Current Students

Dinesh Kumaravel	Ph.D. student
Kevin Antony	Ph.D. student
Shyam Nair	Ph.D. student
Shinoj Nair	Ph.D. student
Anushka Perera	Ph.D. student
Khanh Tran	Ph.D. student
Ashley Park	Undergrad student
Aman Roy	Undergrad student
Zerah Davis	Undergrad student
Pavan Ahluwalia	Undergrad student
Rachel Ko	Undergrad student

## 3) Past Graduated Students (\*Work in microelectronic industry, 20 Ph.D.; 11 M.S.)

Steve Chien*	(M.S. 1994)	Conexant
Min Liu*	(M.S. 1995)	Steag Hama Tech USA
JunJun Wu*	(M.S. 1996)	Lucent
Fei Xu*	(M.S. 1997)	Steag Hama Tech USA
Haiqing Peng	(M.S. 2000)	Rice University
Thomas Ponnuswamy*	(Ph.D. 2002)	Lam Research Inc.
Tana Arunagiri*	(Ph.D. 2003)	Lam Research Inc.
Raymond Chan*	(Ph.D. 2003)	TEL
Oscar Ojeda*	(M.S. 2005)	Intel
Trace Q. Hurd*	(Ph.D. 2005)	TEL
Yibin Zhang*	(Ph.D. 2005)	Intel
Sarah Flores*	(M.S. 2006)	Intel
Praveen Nalla*	(Ph.D. 2006)	Lam Research Inc.
Shyam Venkataraman*	(M.S. 2007)	BASF – Electronics
Fan Yang	(M.S. 2009)	UT Austin
Danny Taylor	(M.S. 2011)	E-chem Sale
Po-Fu Lin	(M.S. 2011)	Medical School
Kyle Kai-Hung Yu*	(Ph.D. 2011)	TEL
Karthik Pillai*	(Ph.D. 2011)	TEL
Jafar Abdelghani	(Ph.D. 2013)	Jordan University
Simon Koskey*	(Ph.D. 2014)	Intel
Tamal Mukherjee*	(Ph.D. 2015)	Intel.
Arindom Goswami	(Ph.D. 2015)	Intel
Sirish Rimal*	(Ph.D. 2015)	IBM
Nick Ross*	(Ph.D. 2016)	Intel

Alex Lambert	(M.S. 2017)	Molecular Instruments, Inc.
Muthappan Asokan	(Ph.D. 2019)	Intel
Goutham Issac Ashok Kumar	Ph.D. (2021)	Intel
Joshua Caperton	(Ph.D. 2022)	Intel
Ashish Salunke	(Ph.D. 2022)	Micron Technology
John Alptekin	(Ph.D. 2023)	TI
Dinesh Kumaravel	(Ph.D. 2026 expected)	Micron Technology

#### 4) Former Undergraduate Research Students

William F. Ikerd	undergraduate (94)	Washington University
Soraksmey Chhim	undergraduate (98)	Texas A&M
Patrick W. Goodwill	undergraduate (98)	Stanford University
Abhi Prasad	undergraduate (98)	Nebraska Medical School
Ketul Parikh	undergraduate (00)	MIT
Vivian Liang	undergraduate (01)	Motorola
Christ Cheng	undergraduate (03)	Duke University
John Sarik	undergraduate (03)	UT-Austin
Jennifer Hanson	undergraduate (03)	Michigan University
Davin Mcdow	undergraduate (04)	Oklahoma Baptist University
Joe Chen	undergraduate (04)	Stanford University
Jason Snitker	undergraduate (15)	
Nicklas Rydberg	undergraduate (15)	UT-Southwestern Med. School
Mark A Hix	undergraduate (15)	UNT
Casey Love	undergraduate (15)	
Kevin Lu	undergraduate (17)	UT
William Yi	undergraduate (17)	TA&M
Zach Thompson	undergraduate (17)	Georgia Tech
Corbin Waters	undergraduate (18)	TA&M
John Alptekin	undergraduate (19)	UNT
Emily Skinner		
Alexander David	Undergraduate (20)	UT
Jeffrey Chen	Undergraduate (20)	University of Pennsylvania
Mohnish Pai	Undergraduate (20)	
Shaurya Kumar	Undergraduate (20)	
Kyle Martin	Undergraduate (20)	UNT
Amelia Engstrom	Undergraduate (21)	
Eswar Gopalakrishnan	Undergraduate (21)	
Nithin Dodla	Undergraduate (21)	
Pavithra Gopalakrishnan	Undergraduate (21)	
Matthew Rodriguez	Undergraduate (21)	
Logan Estridge	Undergraduate (21)	UNT
Hannah Langerak	Undergraduate (21)	
Hailey Yu	Undergraduate (22)	Emory University
Nathan Tran	Undergraduate (23)	

Shree Mishra	Undergraduate (25)	U of Illinois Urbana-Champaign
Nandini Voruganti	Undergraduate (25)	Columbia University

### 5) Students Advised and Dissertation/Thesis Titles

Steve Chien	"Investigation of Cu Outplating Mechanisms on Silicon Wafer Surfaces"
Min Liu	"Characterization and Applications of Pd/Sn Catalyst in Electroless Plating"
JunJun Wu	"Study on Etching and Charge Transfer Reaction at Silicon Surfaces"
Fei Xu	"Investigation of Ultra-trace Metallic and Organic Contaminants in Semiconductor Processing Environments"
Haiqing Peng	"The Performance of Silicon Based Sensor and Its Applications in Silver Toxicity Studies"
Thomas Ponnuswamy	"Hydrogen Terminated Silicon Surfaces: Development of Sensors to Detect Metallic Contaminants and Stability Studies Under Different Environments"
Raymond Chan	"Interfacial Electrochemistry and Surface Characterization: Hydrogen Terminated Silicon, Electrolessly Deposited Palladium & Platinum on Pyrolyzed Photoresist Films and Electrodeposited Copper on Iridium"
Tana N. Arunagiri	"Interfacial Electrochemistry of Metal Nanoparticles Formation on Diamond and Copper Electroplating on Ruthenium Surfaces"
Oscar Ojeda	"Electrochemical Surface Studies with the Electrochemical Quartz Nanobalance"
Trace Q. Hurd	"Chemistry, Detection, and Control of Metals During Silicon Processing"
Yibin Zhang	"Study of Ruthenium and Ruthenium Oxide's Electrochemical Properties and application as a Cu Diffusion Barrier"
Sarah Flores	"Electrochemical Study of Underpotential Deposition Processes on Transition Metal Surfaces"
Praveen Nalla	"Interfacial Studies of Bimetallic Corrosion in Copper/Ruthenium Systems and Silicon Surface Modification with Organic and Organometallic Chemistry"
Shyam Venkataraman	" Electrodeposition of Copper on Ruthenium Oxides and Bimetallic Corrosion of Copper/Ruthenium in Polyphenolic Antioxidants."
Fan Yang	" Preparation of Ag Metal Nanoparticle on Silicon by Solution Process"
Kyle Kai-Hung Yu	"Interfacial Electrochemistry of Copper and Spectro-electrochemical Characterization of Oxygen Reduction Reaction"
Karthikeyan Pillai	"Copper Electrodeposition on Ru-Ta and Corrosion of Plasma Treated Cu in Post Etch Cleaning Solution"
Po-Fu Lin	"Electrochemical Quartz Crystal Microbalance Study of Bismuth Underpotential Deposition on Ruthenium and on Electrochemically Formed Ruthenium Oxide"
Danny Taylor	"Electrochemical Study of Bismuth UPD Process by Quartz Crystal Microbalance"
Simon Koskey	"Fundamental Studies of Copper Bimetallic Corrosion in Ultra Large Scale Interconnect Fabrication Process"
Jafar Abdelghani	"Interfacial Characterization of Chemical Vapor Deposition Growth Graphene and Electrodeposited Bismuth on Ruthenium Surface"

Arindom Goswami	“Fundamental Studies of Copper Corrosion in Interconnects Fabrication Process and Spectroscopic Investigation of Low-k Structures”
Tamal Mukherjee	“Investigation of Post-Plasma Etch Fluorocarbon Residue Characterization, Removal and Plasma-induced Low-k Damage for Advanced Interconnect Applications”
Sirish Rimal	“Characterization of Post-Plasma Etch Residues and Damage Evaluation on Patterned Porous Low-k Dielectrics using MIR-IR Spectroscopy”
Nick Ross	“Interfacial Electrochemistry of Cu/Al Alloys for IC Packaging and Chemical Bonding Characterization of B-doped Hydrogenated <i>a</i> -Si for Infrared Camera”
Alexander S. Lambert	“Application of UV-Vis Spectroscopy to the Monitoring, Characterization and Analysis of Chemical Equilibria of Copper Etching Baths”
Muthappan Asokan	“Copper wire-bonding reliability: Mechanism and prevention of galvanic Aluminum bond pad corrosion in acidic chloride environments”
Goutham Issac Ashok Kumar	"Corrosion Mechanism and Prevention of Wire Bonded Device in Microelectronic Manufacturing & Spectroscopic Investigation of Copper Electrochemical Equilibria for High Density Interconnect Application".
Joshua Caperton	“Chemically Optimized Cu Etch Bath Systems for High-Density Interconnects and the FTIR Operando Exploration of the Nitrogen Reduction Reaction on a Vanadium Oxynitride Electrocatalyst”
Ashish Salunke	“Real-time Interfacial FTIR-Electrochemical Investigation of Smart Passivation Film for Extended Lifetime of Copper Containing Microelectronic Devices”
John Alptekin	“ Investigation of Cu-Al Bonding Interface: Eliminating Bimetallic Corrosion Failures, And Enabling Next-gen Cu-Cu Wirebonding By Nanometer Interfacial Chemistry Control”
Dinesh Kumaravel	“Investigation of Metal-Selective Passivation Coatings and Deep Eutectic Solvents to Mitigate Cu-Al Galvanic Corrosion and Post-Etch Residues in Advanced Integrated Circuit Manufacturing”

## 6) Undergraduate Theses

William F. Ikerd	"The Next Generation Ultra-sharp Tips for the Scanning Tunneling Microscope"
Patrick Goodwill	"Sensor for Trace Metallic Detection in Wafer Processing Chemicals"
Soraksmeey Chhim	"Copper Metal Deposition on Silicon Wafer Substrate with Electrochemical Techniques"
Ketul Parikh	"Selective Deposition of Polyaniline on Modified Silicon Surfaces"
Vivian Liang	"Preparation and Characterization of Platinum and Palladium Nanoparticles on Pyrolyzed Photoresist Film"
Chris Chen	"Electrodeposition of Silver and Copper on a Ruthenium Substrate"
John Sarik	"The Exploration of Silver and a Copper/Silver Multilayer Electrodeposition for the Novel Metal Interconnects in Integrated Circuits"

Jennifer Hanson	"RuO <sub>2</sub> /Ru Stack: a Potential Copper Diffusion Barrier in Sub-0.13 μm Generation Integrated Circuits"
Davin Mcdow	"Electrodeposition of Copper on a Iridium and Iridium Oxide Surfaces"
Natalli Sealover	"Interfacial Chemistry on Silicon(111) Surface."
Joe Chen	"Underpotential Deposition of Cu on Nobel Metal Surfaces"

## Service to Department, University and Public

- Chair, Personnel Affairs Committee (2015-2016, 2003-2004, 2008-2009, 2023-2024)
- Personnel Affairs Committee (2021-present, 2007-2010, 2014-2016, 2002-2004, 1998-2000, 2021-2023)
- Task Force Member, UNT CHIPS Proposal Task Force. (2022 - Present).
- Task Force Member, UNT Faculty Representative to meet with Taiwanese Semiconductor Delegation (2023).
- Member, Center for Microelectronics in Extreme Environments (CMEE) (2024 - Present)
- Chair of Non-Tenure Track Faculty Reappointment/Promotion Committee for Research Faculty (2022-2025)
- Personnel Affairs Committee (2021-2023)
- Chair, Library Committee for Chemistry (1996-present)
- Chair, Mentoring Committee-Dr. Sreekar Marpu (2021-2022)
- Graduate Faculty Member (Category III) (1996-present)
- Promotion and Tenure Committee (1998-present)
- UNT CART-Cleanroom Advisory Committee (2016-present)
- Promotion and Tenure Subcommittee – Dr. Seare Berhe (2007-present)
- Promotion and Tenure Subcommittee – Dr. Sreekar Marpu (2021-2022)
- Chair, Department Appeal Standing Committee (2017-2021)
- Chair, Chemistry Website Committee (2006-2009)
- Graduate recruiting Committee (1998-1999)
- Graduate Affairs Committee (2000-2003)
- Undergraduate Affairs Committee (1993-1998)
- Promotion and Tenure Subcommittee – Dr. Steve Cooke (2007 - 2010)
- Departmental Photographer (2007-2018)
- TAMS Dean Evaluation Committee (2009-2010)
- UNT Clean Room Working Group (2008-2010)
- UNT Faculty Ambassador (2007-2014)
- Welch Chair Professor Search Committee (2001-2003, 2019-2020)
- UNT Surface Engineering Cluster Search Committee (2008-2010)
- Materials Chemistry Search Committee (1998-2000)
- Organic Professor Search Committee (2000-2001)
- Physical/Organic Professors Search Committee (2004-2005)
- Analytical Faculty Search Committee (1996-1997)

- UNT CAS Web Review Committee (2007-2013)
- Advisor: American Chemical Society Student Affiliates (2008-2010)
- Reviewer for Faculty Research Grant Program (1993-2008)
- Expert witness for the Office of Attorney General, State of Texas (2001)
- Instrumentation Committee (1998-2003)
- Interviewer for the UNT Texas Academy of Mathematics and Science (1995-1998)