

Miltiadis K. Hatalis, Ph.D.

Professional Summary

Miltiadis (Miltos) Hatalis is a Professor in the Department of Electrical and Computer Engineering at Lehigh University. He received his B.S. degree in Physics from Aristotle University, Greece in 1982, the M.S. degree in Electrical Engineering from SUNY Buffalo in 1984, and the Ph.D. degree in Electrical Engineering from Carnegie Mellon University in 1987. He is teaching courses on semiconductor devices, circuits, VLSI, and photovoltaic energy systems. His research interests are on electronic materials, devices and circuits for flat panel displays, sensors, and integrated microsystems on a variety of rigid or flexible substrates including silicon, glass, metal foils, plastic, and paper. His research group is being involved with the low temperature polysilicon and the metal oxide thin film transistor (TFT) technologies. Prof. Hatalis has received \$13.6 million of research funding and has been the Principal or Co-Principal Investigator of 41 research programs. Some of his group notable system demonstrations include a flexible VGA AMOLED display, flexible integrated circuits on metal foils, and large area sensor arrays for biometric and gas sensing applications. Prof. Hatalis has served as a consultant to several companies in the flat panel display and semiconductor field and as an expert on 12 patent litigation cases including as a testifying witness in an ITC case. He is the author or co-author of over 175 technical publications including three issued patents, and two book chapters one on AMOLED pixel electronics and one on the polysilicon TFT technology. Prof. Hatalis has served as the PhD advisor of 20 completed PhD dissertations.

Expertise

- Electronic Materials & Micro/Nano Electronic Fabrication Processes
- Flat Panel Displays (TFT-LCDs, AMOLEDs)
- Flexible Displays & Flexible Electronics
- Micro/Nano Electronic Devices & Integrated Circuits
- Sensor and Transducer Arrays
- Thin Film Transistor Technologies
- VLSI

Education

Doctor of Philosophy (Ph.D.)	Electrical and Computer Engineering,	1987
	Carnegie Mellon University, Pittsburgh, PA USA	
Master of Science (M.S.)	Electrical and Computer Engineering,	1984
	State University of New York at Buffalo, NY, USA	
Bachelor of Science (B.S.)	Physics	1982
	Aristotle University of Thessaloniki, Greece	

Professional Experience

Academia

1995-today	Professor	Lehigh University, Bethlehem, PA Department Electrical & Computer Engineering
2003-2008	Professor	Aristotle University, Greece Department of Computer Science
1991-1995	Associate Professor	Lehigh University, Bethlehem, PA Department Electrical & Computer Engineering
1987-1991	Assistant Professor	Lehigh University, Bethlehem, PA Department Electrical & Computer Engineering

1993-today	Director	Display Research Laboratory Lehigh University
2010-2013	Interim Director	Sherman Fairchild Center for Solid State Studies Lehigh University
1988-1993	Associate Director	Microelectronics Research Laboratory Lehigh University

Industry

From: 1987
To: Present
Title: Independent Consultant
Summary: List of Clients:

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| <ul style="list-style-type: none">▪ Air Products▪ Alcoa▪ Corning▪ Diamonex▪ Dow Corning▪ eMagin▪ IBM▪ Intevac | <ul style="list-style-type: none">• Kodak• Litton Systems Canada• Motorola Solutions• Next Biometrics• Sharp Labs of America• Spire• Sterling Diagnostics• Versatilis |
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1992	Visiting Scientist	XEROX Palo Alto Research Laboratory
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Expert Engagements for Patent Litigation Cases

Total Court Appearances: 1 (testified at an International Trade Commission (ITC) trial)

Total Deposition Days: 12

Total Expert Reports: 21

12)

Law Firm: Covington & Burling, LLP

Case Name: MiiCs & Partners America, et al. v. Toshiba, et al. Samsung Electronics Co., (Civil Action No. 1:14-cv-00803-RGA),
MiiCs & Partners America, et al. v. Funai, et al. Samsung Electronics Co., (Civil Action No. 1:14-cv-00804-RGA)

Services Provided: Engaged as Expert for Samsung on three patents. Prepared three Invalidity, three Rebuttal (Non-infringement) and three Reply Expert Reports. Also developed non-infringing alternatives that resulted in low damages. I was deposed for all reports.

Disposition: Judge ruled in favor of defendant's MSJ on non-infringement for two of the patents. Plaintiffs agreed to dismiss the case for the third patent.

Date: 2016 - 2017

11)

Law Firm: Hogan Lovells, LLP

Case Name: Round Rock Research LLC v. Ricoh Corporation, (Civil Action No. 1:15-CV-00157-SLR)

Services Provided: Engaged as Expert for Ricoh. Prepared two expert reports in support of requests to USPTO for Inter Parties Review of two patents.

Disposition: Case settled prior to USPTO making a decision.

Date: 2016

10)

Law Firm: O'Melveny & Meyers, LLP

Case Name: Samsung Electronics Co. LTD., et. al. v. NVIDIA Corporation, (Civil Action No. 3:14-CV-00757)

Services Provided: Engaged as Expert for Samsung

Disposition: Undisclosed

Date: 2014 – 2015

9)

Law Firm: Covington & Burling, LLP

Case Name: The Penn State Research Foundation v. Samsung, (Civil Action No. 4:14-CV-00124-MWB (M.D.Pa))

Services Provided: Engaged as Expert for Samsung on one patent. Performed invalidity analysis and provided non-infringement contentions.

Disposition: Complainant withdrew the complaint.

Date: 2014

8)

Law Firm: Jeffer Mangels Butler & Mitchell, LLP

Case Name: SEL vs. Innolux

Services Provided: Engaged as Expert for Innolux on five patents. Prepared seven expert reports in support of requests to USPTO for Inter Parties Review of five different patents. I was deposed separately for each of these seven reports.

Disposition: Case settled prior to USPTO making a decision.

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Date: 2012 – 2013

7)

Law Firm: Cozen O' Connor, LLP
Case Name: EIDOS vs. AUO, et. al., Civil Action No. 6:11-CV-201-LED-JDL
Services Provided: Engaged as Expert for Innolux
Disposition: Undisclosed
Date: 2013

6)

Law Firm: O'Melveny & Meyers, LLP
Case Name: AUO v. Samsung, (Civil Action No. 3:09-CV-00001-BBC)
Services Provided: Engaged as Expert for Samsung
Disposition: Undisclosed
Date: 2011

5)

Law Firm: White & Case, LLP
Case Name: Thomson v. CMI, (Investigation No. 337-TA-741 and Investigation No. 337-TA-749)
Services Provided: Engaged as Expert for CMI. Prepared one invalidity and one non-infringement expert reports. I was deposed for these reports. I testified in the ITC trial.
Disposition: ITC ruling was favorable to CMI and it was affirmed by US Court of Appeals for the Federal Circuit.
Date: 2011

4)

Law Firm: O'Melveny & Meyers, LLP
Case Name: SEL v. Samsung, (Civil Action No. 3:09-CV-00001-BBC)
Services Provided: Engaged as Expert for Samsung
Disposition: Undisclosed
Date: 2009

3)

Law Firm: Irell & Manella, LLP
Case Name: LG v. CMO, (Civil Actions No.06-726 (JJF) & 07-357 (JJF) Consolidated Cases)
Services Provided: Engaged as Expert for CMO
Disposition: Undisclosed
Date: 2008

2)

Law Firm: Howrey, LLP
Case Name: SEL v. CMO, (Case No. C 04-04675 MH)
Services Provided: Engaged as Expert for CMO. I prepared a non-infringement expert report. I was deposed for that report
Disposition: Judge ruled in favor of defendant's MSJ on non-infringement.
Date: 2007

1)

Law Firm: Morrison & Foerster
Case Name: SEL v. Sanyo
Services Provided: Engaged as expert for Sanyo
Disposition: Undisclosed
Date: 2001

Professional Affiliations and Involvement in Professional Societies

Affiliations: IEEE Electron Device Society, Society for Information Display (SID)

Editorships:

- “Flat Panel Display Materials II,” Materials Research Society Symposium Proceedings vol. 424, Published by the Materials Research Society, 1997.
- “Proceedings of the Second International Workshop on Active Matrix Liquid Crystal Displays,” Published by the IEEE Society, 1996

Chairman of the organization committee for the following workshops/conferences:

- International Workshop on Active Matrix Displays
 - It was sponsored by the Society of Information Display in co-operation with IEEE Electron Devices Society. It was held during the International Display Research Conference in Toronto, Canada, on September 20-23, 1997. There were 9 invited papers and 120 attendees.
- Flat Panel Display Materials II
 - Meeting held during Spring 1996 Meeting of the Materials Research Society. During the three day Symposium a total of 118 papers were presented. Prof. Hatalis was responsible for selecting the co-organizers, raising financial support, prepare the technical program and edit Symposium Proceedings.
- Second International Workshop on Active Matrix Liquid Crystal Displays
 - It was organized in co-operation with Society for Information Displays and the IEEE Electron Devices Society. It was held at Lehigh University on September 25-26, 1995. There were 11 invited and 25 contributed papers and 130 attendees.
- First International Workshop on Active Matrix Liquid Crystal Displays
 - Workshop sponsored by the Society of Information Display in co-operation with IEEE Electron Devices Society. It was held during the International Display Research Conference in Monterey CA, on October 10-13, 1994. There were 10 invited and 22 contributed papers and 170 attendees.
- Active Matrix Liquid Crystal Displays Symposium
 - It was organized in co-operation with Society for Information Display and IEEE Electron Devices Society. It was held at Lehigh University, on October 21-22, 1993. Seven invited and 35 contributed papers were presented. Attendance was 160.

Member of the organization committee for the following workshops/conferences:

- Active Matrix Liquid Crystal Displays Technology and Applications
 - Sponsored by the International Society for Optical Engineering (SPIE). USA, 1997
- Sixth International Conference on Polycrystalline Semiconductors
 - Conference was held in FRANCE, 2000
- Flat Panel Display Technology II
 - Sponsored by the International Society for Optical Engineering (SPIE). USA, 2001
- EURO-CVD Conference
 - Sponsored by the European Materials Research Society GREECE, 2001
- International Workshop on Active Matrix Liquid Crystal Displays
 - Sponsored by the Japan Society of Applied Physics, JAPAN: 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006
- IEEE Photonics Conference 2013
 - Member of the committee for Displays and Lighting Sessions

Patents & Publications

Total Citations 3,746 as of 12/9/2017 according to Google Scholar, H-index of 26

Patent	<u>Date</u>	<u>Description</u>
US Patent 8,390,536	March 5, 2013	Active Matrix Display and Method
Korean Patent No. 10-2009-7014517	November 2014	Active Matrix Display and Method
Japanese Patent 6043044	November 18, 2016	Active Matrix Display and Method

Book Chapters

1. "Technology of Polysilicon Thin Film Transistors." A. T. Voutsas and M. K. Hatalis. Chapter 4 in the book "Thin Film Transistors" edited by C. Kagan and P. Andy. Published by Marcel Dekker, Inc. 2003.
2. "AMOLED Display Pixel Electronics." M. Troccoli, M. K. Hatalis, A. T. Voutsas, Chapter 10, in the book "Organic Electroluminescence" edited by Z. Kafafi and H. Murata. Published by CRC Press & SPIE Press, 2005, p. 355.

Journal Papers

1. "High Performance Thin Film Transistors in Low Temperature Crystallized Amorphous Silicon Films" IEEE Electron Device Letters, vol. EDL-8, pp. 361-364, 1987. M. K. Hatalis and D. W. Greve.
2. "Solid Phase Epitaxy of LPCVD Amorphous Silicon Films." Journal of the Electrochemical Society, vol. 134, pp. 2536-2540, 1987. M.K. Hatalis and D.W. Greve.
3. "Large Grain Polycrystalline Silicon by Low Temperature Annealing of LPCVD Amorphous Silicon Films." Journal of Applied Physics, vol. 63, pp. 2260-2266, 1988. M.K. Hatalis and D.W. Greve.
4. "Interfacial Oxide, Grain Size and Hydrogen Passivation Effects on Polysilicon Emitter Transistors," IEEE Transactions on Electron Devices, vol. ED-35, pp. 1334-1343, 1988. P.A. Potyraj, D.L. Chen, M.K. Hatalis, and D.W. Greve.
5. "Minimum Detectable Solute Concentration by Atomic - Resolution TEM." Acta Crystallographica A, vol. A44, pp. 449-461, 1988. J.M. Howe, D.P. Basile, N. Prabhu, and M.K. Hatalis.
6. "Low Temperature Polycrystalline Silicon Thin Film Transistors for Displays" IEEE Transactions on Electron Devices, vol. ED-35, pp. 1842-1845, 1988. B.C. Hsieh, M.K. Hatalis and D.W. Greve.
7. "Alternate Surface Cleaning Approaches for UHV/CVD Epitaxy of Si and GeSi_{1-x}." Journal of the Electrochemical Society, vol. 138, pp. 3783-3789, 1991. M. Racanelli, D.W. Greve, M. K. Hatalis and L. J. van IJzendoorn.
8. "Investigations on Quality of Polysilicon Film-Gate Dielectric Interface in Polysilicon Thin Film Transistors." Thin Solid Films, vol. 216, pp. 137-141, 1992. J.-H. Kung, M. K. Hatalis and J. Kanicki.
9. "Fluorine-Enhanced Oxidation of Polycrystalline Silicon and Application to Thin Film Transistor Fabrication" Applied Physics Letters, vol. 61, pp. 937-939, 1992. D. N. Kouvatsos, M. K. Hatalis and R. J. Jaccodine.

10. "Structure of as-Deposited LPCVD Silicon Films at Low Deposition Temperatures and Pressures." *Journal of the Electrochemical Society*, vol. 139, pp. 2659-2665, 1992. A. T. Voutsas and M. K. Hatalis.
11. "Surface Treatment Effect on the Grain Size and Surface Roughness of as Deposited LPCVD Silicon Films." *Journal of the Electrochemical Society*, vol. 140, pp. 282-288, 1993. A. T. Voutsas and M. K. Hatalis.
12. "Deposition and Crystallization of a-Si Low Pressure Chemically Vapor Deposited Films Obtained by Low-Temperature Pyrolysis of Disilane." *Journal of the Electrochemical Society*, vol. 140, pp. 871-877, 1993. A. T. Voutsas and M. K. Hatalis.
13. "Crystallized Mixed-Phase Silicon Films for Thin Film Transistors on Glass Substrates." *Applied Physics Letters*, vol. 63, pp. 1546-1548, 1993. A.T. Voutsas and M.K. Hatalis.
14. "Properties of the Cadmium Selenide Thin Films as a Function of Lateral Distance from Chromium Contacts," *Journal of the Electrochemical Society*, vol. 140, pp. 2994-2998, 1993. D. Waechter, M. R. Westcott, F. Lin, and M. K. Hatalis.
15. "Structural Characteristics of as-Deposited and Crystallized Mixed-Phase Silicon Films." *Journal of Electronic Materials*, vol. 23, pp. 319-330, 1994. A. T. Voutsas and M. K. Hatalis.
16. "Experimental and Theoretical Study on the Crystallization of Chemically Vapor Deposited Mixed-Phase Silicon Films," *Journal of Applied Physics*, vol. 76, pp. 777-790, 1994. A. T. Voutsas and M. K. Hatalis.
17. "Characterization of Cobalt Annealed on Silicon-Germanium Epilayers." *Thin Solid Films*, vol. 250, pp. 20-25, 1994. F. Lin, G. Sarcona, M. K. Hatalis, A. Cherhati, E. Austin and D. W. Greve.
18. "Raman Spectroscopy of Amorphous and Microcrystalline Silicon Films Deposited by Low Pressure Chemical Vapor Deposition" *Journal of Applied Physics*, vol. 78, pp. 6999 - 7005, 1995. A. T. Voutsas, M. K. Hatalis, J. Boyce and A. Chiang.
19. "High performance thin film transistors in large grain size polysilicon deposited by thermal decomposition of disilane," *IEEE Transactions on Electron Devices*, vol. 43, pp. 1399 - 1406, 1996. D. N. Kouvatsos, A. T. Voutsas, and M. K. Hatalis.
20. "Leakage current mechanism in submicron polysilicon thin film transistors" *IEEE Transactions on Electron Devices*, vol. 43, pp. 1218 - 1223, 1996. K. Olasupo and M. K. Hatalis.
21. "The effect of drain offset on current-voltage characteristics in sub-micron polysilicon thin film transistors," *IEEE Transactions Electron Devices*, vol. 43, pp. 1306-1308, 1996. K. Olasupo, W. Yarbrough and M. K. Hatalis.
22. "Single crystal silicon thin film transistors fabricated at low process temperatures on glass substrates" *Electronics Letters*, vol. 32, pp. 775 - 777, 1996. N. Kouvatsos, D. Tsoukalas, G. T. Sarcona, M. K. Hatalis and J. Stoemenos.
23. "Polycrystalline silicon thin film transistors fabricated at reduced thermal budgets by utilizing fluorinated gate oxidation." *IEEE Transactions on Electron Devices*, vol. 43, pp. 1448 - 1453, 1996. D. N. Kouvatsos and M. K. Hatalis.
24. "Nickel Silicides Grown on Amorphous Silicon and Silicon-Germanium Thin Films." *Electrochemical and Solid State Letters*, vol. 1, p. 233-234, 1998. G. Sarcona, S. K. Saha, and M. K. Hatalis.
25. "Non-Erratic Behavior of Overerased Bits in Flash EEPROM" *Journal of Vacuum Science and Technology B*, vol. 16, p 3065-3068, 1998. F. Nkansah, E. Prinz, and M. K. Hatalis.
26. "Thin Film Transistors in Low Temperature As-deposited and Reduced Crystallization-Time Polysilicon on 665 C Strain Point Glass Substrates." *Thin Solid Films*, vol. 338, pp. 281-285, 1999. M. K. Hatalis, D. N. Kouvatsos, J. H. Kung, A. T. Voutsas, and J. Kanicki.

27. "Silicidation Reactions with Co – Ni Bilayers for Low Thermal Budget Microelectronic Applications." *Thin Solid Films*, vol. 347, pp. 278-283, 1999. S. K. Saha, R. S. Howell, and M. K. Hatalis.
28. "Effect of Flash EEPROM Floating Gate Morphology on Electrical Behavior of Fast Programming Bits." *IEEE Transaction on Electron Devices*, vol. 46, pp. 1355- 1362, 1999. F. Nkansah and M. K. Hatalis.
29. "Polysilicon Thin Film Transistors using Self-Aligned Cobalt and Nickel Silicide Source and Drain contacts" *IEEE Electron Device Letters*, vol. 20, pp. 332-334, 1999. G. Sarcona, M. Stewart, and M. K. Hatalis.
30. "Elimination of Hillock Formation in Al Interconnects Using Ni or Co" *Journal of Applied Physics*, vol. 86, pp. 625-633, 1999. S. K. Saha, R. S. Howell, and M. K. Hatalis.
31. "Reaction Mechanisms in Al-ITO Ohmic Contact Metallization with Co and Ni Barrier Layers for Active Matrix Display Applications." *Journal of Electrochemical Society*, vol. 146, pp. 3134-3138, 1999. S. K. Saha, R. S. Howell, and M. K. Hatalis.
32. "Polycrystalline Silicon Thin Film Transistors in Various Solid Phase Crystallized Films Deposited on Glass Substrates" *Journal of Electronic Materials*, vol. 28, pp. 19-25, 1999. D. N. Kouvatso, A. T. Voutsas, and M. K. Hatalis.
33. "Preparation and Stability of Low Temperature Cobalt and Nickel Silicides on Thin Polysilicon Films." *Journal of Vacuum Science and Technology A*, vol. 18, pp. 97- 93, 2000. R. S. Howell, G. Sarcona, and M. K. Hatalis.
34. "Poly-Si Thin Film Transistors on Steel Substrates" *IEEE Electron Device Letters*, vol. 21, pp. 70-72, 2000. R. S. Howell, M. Stewart, S. V. Karnik, S. K. Saha, and M. K. Hatalis.
35. "High Performance Gated Lateral Polysilicon PIN Diodes," *Solid State Electronics*, vol. 44, pp.1613-1619, 2000. M. Stewart and M. K. Hatalis.
36. "Characterization and Modeling of Fast Programming Bits in Flash EEPROM" *Solid State Electronics*, vol. 44, pp. 1887-1897, 2000. F. Nkansah, M. K. Hatalis and K. Olasupo.
37. "Polysilicon TFT Technology for Active Matrix OLED Display," *IEEE Transaction on Electron Devices*, vol. 48, pp. 845-851, 2001. M. Stewart, R. S. Howell, L. Pires, and M. K. Hatalis.
38. "Novel Cleaning Methodology for Steel Substrates in Microelectronic Fabrication." *Journal of Electrochemical Society*, vol. 149, pp. G143-G146, 2002. R. S. Howell and M. K. Hatalis.
39. "Trade Off Between Polysilicon Film Quality and Thin Film Transistor Operational Amplifier DC Gain." *Solid State Electronics*, vol. 46/9, pp. 1421-1425, 2002. T. Afentakis and M. K. Hatalis.
40. "A Simple Analytical Model for the Dependence of the Propagation Delay of the Polycrystalline Silicon CMOS Inverter on Temperature" *Solid State Electronics*, vol. 46/12, pp. 2301-2306, 2002 T. Afentakis and M. K. Hatalis.
41. "Palladium based Micro-Membrane for Water Gas Shift Reaction and Hydrogen Gas Separation." *J. of Microelectromechanical Systems*, vol. 12, pp.: 93- 100, 2003. S. V. Karnik, M. K. Hatalis, M. V. Kothare.
42. "Implementations of Rapid Thermal Processes in Polysilicon TFT Fabrication." Accepted for Publication by Elsevier for a Special Volume on Rapid Thermal Processing for Future Semiconductor Devices M. K. Hatalis and A. T. Voutsas.
43. "Lateral Polysilicon p⁺-p-n⁺ and p⁺-n-n⁺ Diodes." *Solid State Electronics*, Vol. 47, pp. 653-659, 2003 S. V. Karnik and M. K. Hatalis.
44. "Multiple Lateral Polysilicon Diodes as Temperature Sensors for Chemical Microreaction Systems," *Japanese Journal of Applied Physics (JJAP)*, vol. 42, pp.1200-1205, 2003. S.V. Karnik and M. K. Hatalis.

45. "Macroelectronics: Perspectives on Technology and Applications," Proceedings of IEEE, vol. 93, pp.1239-1256, 2005. R. H. Reuss, et.al. (M. Hatalis).
46. "Polysilicon TFT Circuits on Flexible Stainless Steel Foils," Solid State Electronics, vol. 50, pp 1080-1087, 2006. M. Troccoli, A. J. Roudbari, T. Chuang, M. Hatalis.
47. "Exciton dissociation by a static electric field followed by nanoscale charge transport in PPV polymer films," Phys. Rev. B (Condensed Matter and Materials Physics), vol. 73, p. 125202, 2006. H. Najafov, I. Biaggio, Ta-Ko. Chuang, M. K. Hatalis.
48. "Design and fabrication of high-performance polycrystalline silicon thin-film transistor circuits on flexible steel foils" IEEE Transactions on Electron Devices, v 53, p 815-22, 2006. T. Afentakis, M. Hatalis, A. Voutsas and J. Hartzell.
49. "Water Gas Shift Reaction in a Glass Microreactor," Catalysis Today, vol. 120, p.107–120, 2007. S. Mukherjee, M. K. Hatalis, and M. V. Kothare.
50. "Top-emitting 230 dots/in. Active-Matrix Polymer Light-Emitting Diode Displays on Flexible Metal Foil Substrates," Applied Physics Letters 90, 151114 (2007). T.-K. Chuang, M. Troccoli, P.-C Kuo, A. Jamshidi, M. K. Hatalis; I. Biaggio; A. T. Voutsas.
51. "Polysilicon TFT technology on Flexible Metal Foils for AM-PLED displays," Invited paper: Journal of Society for Information Displays, 15, 455 (2007). T.-K. Chuang, M. Troccoli, M. K. Hatalis, and A. T. Voutsas.
52. "Process Technology for High-Resolution AM-PLED Displays on Flexible Metal Foil Substrates," Electrochemical and Solid-State Letters, 10, J92 (2007). T.-K. Chuang, M. Troccoli, P.-C Kuo, A. Jamshidi, M. K. Hatalis, A. T. Voutsas, and T. Afentakis.
53. "Effect of mechanical strain on mobility of polycrystalline silicon thin-film transistors fabricated on stainless steel foil." Applied Physics Letters, 91, 243507 (2007). Po-Chin Kuo, Abbas Jamshidi-Roudbari and Miltiadis Hatalis.
54. "High Voltage, Moderate Current Thin Film Transistor for Actuator Applications," ECS Trans., vol. 11, pp: 31-39, 2008. A. Jamshidi-Roudbari, P.C. Kuo, and M. Hatalis.
55. "Luminescence of Intraporous Cerium(III) Complexes in Alkyl Sulfonic Mesoporous." Chemistry of Materials, vol. 20, pp. 1359-1366, 2008. Klier, K., Miller, A., Zhang, L., Hatalis, M.
56. "Tactile displays: Overview and recent advances." Displays, Vol. 29, pg. 185-194, 2008. V. G. Chouvardas, A. N. Miliou, M. K. Hatalis.
57. "Crystallization of amorphous silicon thin films: comparison between experimental and computer simulation results." Journal of Materials Science, Vol. 43, pg. 3976- 3981, 2008 J. Kioseoglou, P. Komninou, G. P. Dimitrakopoulos, I. P. Antoniadis, M. K. Hatalis and T. Karakostas.
58. "Effect of mechanical strain on laser crystallized polysilicon thin film transistors and ring oscillators fabricated on stainless steel foil." Solid-State Electronics vol. 52, pg.1594-1601, 2008. Abbas Jamshidi-Roudbari, Po-Chin Kuo, Miltiadis Hatalis.
59. "Electronic Structure of CeF₃ and TbF₃ by valence-band XPS and theory." Journal of Physics and Chemistry of Solids, vol. 70, pg. 1302-1311, 2009. K. Klier, P. Novak, A.C. Miller, J.A. Spirko and M.K. Hatalis.
60. "Effects of Mechanical Strain on Characteristics of Polycrystalline Silicon Thin Film Transistors Fabricated on Stainless Steel Foil." IEEE Journal of Display. Technology, vol. 5, pg. 202-205, 2009. Po-Chin Kuo, Abbas Jamshidi-Roudbari, and Miltiadis Hatalis.
61. "Electrical characteristics and mechanical limitation of polycrystalline silicon thin film transistor on steel foil under strain" Journal of Applied Physics, vol. 106, 114502 (2009). Po-Chin Kuo, Abbas Jamshidi-Roudbari and Miltiadis Hatalis.

62. "A Flash Analog to Digital Converter on Stainless Steel Foil" Solid-State Electronics, vol. 54, pg. 410-416, 2010. A. Jamshidi-Roudbari, P.C. Kuo, and M. Hatalis.
63. "High Frequency Half-Bit Shift Register with Amorphous Oxide TFT." IEEE Electron Device Letters, vol. 31, pg. 320-322, 2010. A. Jamshidi-Roudbari, S. A. Khan, and M. K. Hatalis.
64. "Integrated Full-Bit Shift Register by Low-Temperature Amorphous Indium Gallium Zinc Oxide Thin-Film Transistors." Electrochemical and Solid State Letters, vol. 14, pg. J19-J21, 2011. Abbas Jamshidi-Roudbari, Shahrukh Akbar Khan, and Miltiadis K. Hatalis.
65. "Voltage Noise Characteristics of Polysilicon P-I-N Diodes." IEEE Transactions on Electron Devices, vol. 58, pg. 1054-1062, 2011. A. Jamshidi-Roudbari and M. K. Hatalis.
66. "Amorphous oxide Thin Film Transistors with Methyl Siloxane Based Gate Dielectric on Paper Substrate." Electrochemical and Solid State Letters, vol. 14, pg. H247-H249, 2011. Nackbong Choi, Shahrukh Khan, and Miltiadis K. Hatalis.
67. "Origin of low-frequency noise in the low drain current range of bottom-gate amorphous IGZO thin-film transistors." IEEE Electron Device Letters, vol. 32, pg. 898-900, 2011. C. G. Theodorou, A. Tsormpatzoglou, C. Dimitriadis, S. Khan, M. K. Hatalis, J. Jomaah, G. Ghibaudo.
68. "A modified offset roll printing for thin film transistor applications." Microelectronics Engineering, vol. 91, pp. 93-97, 2012. N. Choi, H. Wee, S. Nam, J. Lavelle, and M. K. Hatalis.
69. "Interface diffusion characteristics of Al-2 at.%Nd/n + a-Si:H and Al-2 at.%Nd/n + poly-Si bilayers." Thin Solid Films, vol. 520, pp. 1982-1987, 2012. Nackbong Choi, Soo-Young Yoon, Chang-Dong Kim, and Miltiadis Hatalis.
70. "Comparative Study of Active-Over-Metal and Metal-Over-Active Amorphous IGZO Thin-Film Transistors with Low Frequency Noise Measurements." IEEE Electron Device Letters, vol. 33, pp. 555-557, 2012. Andreas Tsormpatzoglou, Nikolaos A. Hastas, Shahrukh Khan, Charalabos A. Dimitriadis, Miltiadis Hatalis.
71. "Design and simulation of a tactile display based on a CMUT array." International Journal of Electronics, vol. 99, pp. 1351-1363, 2012. V. Chouvardas, M. Hatalis and A. N. Miliou.
72. "Optimizing the design of a tactile display based on a capacitive micromachined ultrasonic transducer array." International Journal of Numerical Modelling: Electronic Networks, Devices and Field, vol. 26, pp. 448-456, 2013. V. G. Chouvardas, M. K. Hatalis and A. N. Miliou.
73. "Characterization of High Current Stress Induced Instability in Amorphous InGaZnO Thin Film Transistors by Low Frequency Noise Measurements" IEEE Electron Device Letters, vol. 34, pp. 1403-1405, 2013. A. Tsormpatzoglou, N. Hastas, F. Mahmoudabadi, N. Choi, M. K. Hatalis and C. A. Dimitriadis.
74. "Analytical surface-potential-based drain current model for amorphous InGaZnO thin film transistors." Journal of Applied Physics, v 114, 184502, 2013. A. Tsormpatzoglou, N. Hastas, N. Choi, F. Mahmoudabadi, M. K. Hatalis and C. A. Dimitriadis.
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76. "Novel analog feedback current programming architecture compatible with 2-transistor 1-capacitor pixel for active matrix organic light-emitting diode displays." Journal of the Society for Information Display, v 22, p 204-215, 2014. Thomas Charisoulis, Matias N. Troccoli, Douglas R. Frey, Miltiadis K. Hatalis.
77. "Current feedback compensation circuit for 2T1C LED displays: Method." IEEE Transactions on Circuits and Systems I: Regular Papers, v 62, p 2423-2433, 2015. Thomas Charisoulis, Douglas R. Frey, Miltiadis K. Hatalis.

Refereed Conference Papers

1. "Solid Phase Epitaxy of LPCVD Silicon Films and Their Use as Diffusion Sources." The Electrochemical Society Extended Abstracts, Vol. 86-1, Spring 1986. M. K. Hatalis and D. W. Greve.
2. "TEM Studies of the Amorphous / Crystalline Transition in Silicon and Applications to Electronic Devices." Institute Physics Conference Series, vol. 87, pp. 479-484, 1987 D.W. Greve and M. K. Hatalis.
3. "Crystallization of Amorphous LPCVD Silicon Films and Application to Bipolar and Thin Film Transistors." Materials Research Society Symposium Proceedings, vol. 106, pp. 335-340, 1987 M. K. Hatalis and D. W. Greve.
4. "Thin Film Transistors in Low Temperature Crystallized Amorphous Silicon Films." The Electrochemical Society Extended Abstracts, Vol. 87-1, Spring 1987. M. K. Hatalis and D. W. Greve.
5. "Minimum Detectable Solute Concentration and Accuracy of Compositional Analysis in Atomic-Resolution Microscopy." Proceedings Microbeam Analysis Society, 22nd Annual Mtg., Hawaii, Summer 1987 J. M. Howe, D. P. Basile, N. Prabhu and M. K. Hatalis.
6. "Electrical Characteristics of Polysilicon Thin Film Transistors at Low Temperatures." Proceedings International Topical Conference on Hydrogenated Amorphous Silicon Devices and Technology 1988 M. K. Hatalis and N. Stylianou.
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10. "Hydrogenation of Polycrystalline Silicon Thin Film Transistors." The Electrochemical Society Extended Abstracts, Vol. 91-1, Abstract 410, pp. 629-630, spring 1991 M. K. Hatalis, J. H. Kung and J. Kanicki.
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12. "Nucleation and Crystallization of Amorphous Silicon-Aluminum Thin Films" Materials Research Society Symposium Proceedings, vol. 230, pp. 195-200, 1992 F. Lin, M. K. Hatalis, S. Girginoudi, D. Girginoudi, N. Georgoulas and A. Thanailakis.
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14. "Thin Silicon Dioxide Films Grown at Very Low Oxygen Partial Pressure in Oxygen Diluted by Helium," The Electrochemical Society Extended Abstracts, Vol. 92-2, Fall 1992 D. N. Kouvatso and M. K. Hatalis.
15. "Polysilicon TFTs with various 800°C Thermally Grown Gate Oxides" The Electrochemical Society Extended Abstracts, Vol. 92-2, Fall 1992 J.-H. Kung, D. N. Kouvatso and M. K. Hatalis.
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31. "Effect of Grain Size and Process Temperature on Distribution of Polysilicon TFT's Electrical Characteristics," M. K. Hatalis, D. Kouvatso, S.-H. Lin, and A. T. Voutsas Conference Record of 14th Annual International Display Research Conference, pp. 150-153, 1994 published by Society for Information Displays.
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88. "A new feedback current programming architecture for 2T1C AMOLED displays." Digest of Technical Papers - SID International Symposium, v 44, p 465-468, June 2013. Thomas Charisoulis, Matias N. Troccoli, Douglas R. Frey, and Miltiadis K. Hatalis.
89. "Feedback Architecture for Uniform Brightness in TFT AMOLED Displays." 2013. IEEE Photonics Conference, IPC 2013, p 182-183, 2013. Thomas Charisoulis, Matias N. Troccoli, Douglas R. Frey, and Miltiadis K. Hatalis.
90. "CNT Sensor arrays with P-i-N diode." IEEE SENSORS 2013 - Proceedings. Thomas Charisoulis, Abbas Jamshidi-Roudbari, Miltiadis Hatalis, Nack Bong Choi, Yijiang Lu, and Jing Li.
91. "IGZO TFTs on Aluminum Substrates." Presented to ISDRC 2013 Conference. Forough Mahmoudabadi, Xiaoxiao Ma, Miltiadis K. Hatalis, Kirit N. Shah and Thomas L. Levendusky.
92. "High Performance IGZO TFTs with Modified Etch Stop Structure on Glass Substrates." MRS Symposium Proceedings, v 1633, 2014, Oxide Semiconductors. Forough Mahmoudabadi, Ta-Ko Chuang, Jerry Kung and Miltiadis Hatalis.
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94. "Analytical unified drain current model of amorphous IGZO thin film transistors considering a Gaussian distribution of tail states." Proceedings of the International Conference on Microelectronics, ICM, p 269-272, 2014, 2014 29th International Conference on Microelectronics, MIEL 2014 – Proceedings. Tsormpatzoglou, A.; Hastas, N.A.; Hatalis, M.K.; Dimitriadis, C.A.
95. "RF-sputtered oxide TFTs and circuits on engineered aluminum substrates." Digest of Technical Papers - SID International Symposium, v 45, n 1, p 1043-1046, 2014. Mahmoudabadi, Forough; Charisoulis, Thomas; Hsiang, Kuei-Cheng; Hatalis, Miltiadis; Shah, Kirit N.; Levendusky, Thomas L.
96. "Effect of strain on Characteristics of amorphous In-Ga-Zn-O TFTs fabricated on engineered aluminum substrates ." Digest of Technical Papers - SID International Symposium, v 46, n 1, p 1188-1191, 2015. Forough Mahmoudabadi, Miltiadis Hatalis, Kirit N. Shah, Thomas L. Levendusky

Research Funding

- Total number of research programs: 41
- Total budget: \$13,609,775

Principal Investigator:

1. Title: "Silicon Alloy Thin Films for Solar Cells and Displays"
Agent: State of Pennsylvania / Solarex Corp.
Amount: **\$45,000** Period: 9/88 – 8/89
2. Title: "Thin Film Transistor Studies"
Agent: IBM
Amount: **\$150,750** Period: 9/89 – 8/91
3. Title: "Low temperature Polycrystalline Films for Display Applications"
Agent: Litton Systems Canada Inc.
Amount: **\$58,000** Period: 1989, unrestricted duration
4. Title: "Polysilicon TFTs for Advanced Flat Panel Displays"
Agent: Defense Advanced Research Program Agency
Amount: **\$126,500** Period: 10/90 – 9/91
5. Title: "Development of Electronic Grade CVD Diamond"
Agent: State of Pennsylvania / Diamonex Inc.
Amount: **\$125,000** Period: 9/91 – 8/93
6. Title: "High Performance Polysilicon TFTs for Advanced Flat Panel Displays"
Agent: Defense Advanced Research Program Agency
Amount: **\$260,000** Period: 9/91 – 8/92
7. Title: "Advanced Materials and Devices for High Definition TFT-LCD Displays"
Agent: Defense Advanced Research Program Agency
Amount: **\$1,170,000** Period: 9/92 – 5/96
8. Title: AASERT Award I "Advanced Materials and Devices for High Definition TFT-LCD Displays"
Agent: Defense Advanced Research Program Agency
Amount: **\$216,600** Period: 9/94 – 8/97
9. Title: AASERT Award II "Advanced Materials and Devices for High Definition TFT-LCD Displays"
Agent: Defense Advanced Research Program Agency
Amount: **\$200,000** Period: 9/95 – 8/98

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10. Title: "Low Temperature Polysilicon TFTs in Advanced Display Technologies"
Agent: Defense Advanced Research Program Agency
Amount: **\$1,498,000** Period: 6/96 – 8/99
11. Title: "Acquisition of Advanced Equipment for Rapid Thermal and High Density Plasma Processing for Integrated Circuits and Flat Panel Displays"
Agent: National Science Foundation
Amount: **\$130,000** Period: 9/96 – 8/99
12. Title: "Polysilicon pin Diode Based Direct x-Ray Sensor Array for Application in Fluoroscopy and Radiography"
Agent: Sterling Diagnostic Inc.
Amount: **\$150,000** Period: 9/97 – 12/98
13. Title: "Flexible AMOLED Displays on Metal Foils."
Agent: Army Research Laboratory / Lehigh cooperative program
Amount: **\$1,190,000** Period: 9/03 – 4/05
14. Title: "Novel Active Matrix Organic LED Flexible Displays"
Agent: State of PA; Dept. of Community & Economic Development
Amount: **\$150,000** Period: 3/03 – 2/04
15. Title: "Coordinated Micro-Fabrication Support for COT Projects"
Agent: State of PA; Dept. of Community & Economic Development
Amount: **\$182,006** Period: 1/03 – 12/05
16. Title: "High Performance Macroelectronics Systems for Antenna Applications"
Agent: DARPA, subcontract to Lehigh from Northrop Grumman
Amount: **\$1,078,024** Period: 6/04 – 12/07
17. Title: "Polysilicon Thin Film Devices for Sensor Applications"
Agent: Ben Franklin Technology Partners of State of PA
Amount: **\$300,000** Period: 7/05 – 6/07
18. Title: "Flexible VGA AMOLED & AMPLED Displays on Metal Foils"
Agent: Army Research Laboratory / Lehigh cooperative program
Amount: **\$1,747,168** Period: 4/05 – 5/08
19. Title: "Array Electronics for Multichannel Carbon Nanotube Gas Sensors"
Agent: NASA / Lehigh cooperative program
Amount: **\$114,076** Period: 6/06 – 6/08
20. Title: "Comparison of Different Metal Foils for Flexible Displays"
Agent: United States Display Consortium
Amount: **\$205,000** Period: 12/07 – 5/10

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21. Title: "Development of Active Matrix Arrays for Nanosensors"
Agent: NASA AMES / Homeland Security Department
Amount: **\$269,000** Period: 9/08 – 3/12
22. Title: "Crystalline Silicon Thin Films for Solar Cells"
Agent: State of PA
Amount: **\$55,000** Period: 6/09 – 5/10
23. Title: "SBIR Phase II - Electret Enhanced Organic Solar Cell"
Agent: Versatilis, LLC
Amount: **\$60,000** Period: 1/11 – 6/12
24. Title: "AMOLED Display Drivers"
Agent: The Technology Collaborative
Amount: **\$72,081** Period: 4/11 – 3/12
25. Title: "Research Gift Grant"
Agent: Sharp Laboratories of America Inc.
Amount: **\$100,000** Period: 3/12 – no end date
26. Title: "Effect of Glass Substrates on IGZO TFTs"
Agent: Corning Inc.
Amount: **\$379,000** Period: 4/12 – 6/14
27. Title: "Research Gift Grant"
Agent: Robert Bosch LLC, Research and Technology Center.
Amount: **\$40,000** Received: May 2012
28. Title: "Research Gift Grant"
Agent: Air Products and Chemicals, Inc.
Amount: **\$90,000** Received: September 2012
29. Title: "Research Gift Grant"
Agent: Qualcomm, Inc.
Amount: **\$120,000** Received: January 2013
30. Title: "Research Gift Grant"
Agent: Alcoa, Inc.
Amount: **\$70,750** Received: March 2013
31. Title: "SBIR Phase I - Hybrid Projectile Components Miniaturization"
Agent: Custom Electronics, Inc.
Amount: **\$32,000** Period: 6/15 – 12/15
32. Title: "Research Gift Grant"
Agent: Corning, Inc.
Amount: **\$65,000** Received: June 2015

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33. Title: "EAGER: Plasmonic Transparent Electrodes for Organic Photovoltaics"
Agent: National Science Foundation
Amount: **\$80,000** Period: 7/15 – 6/16
34. Title: "SBIR Phase II - Hybrid Projectile Components Miniaturization"
Agent: Custom Electronics, Inc.
Amount: **\$200,820** Period: 8/16 – 7/18

Co-Principal Investigator:

1. Title: "Physical Electronics of Multi-Dielectric Microstructures."
Agent: National Science Foundation
Amount: **\$55,000** Period: 9/89-5/90 P.I.: M. White
2. Title: "Plasma Oxidation/Anodization of Si films for Photovoltaic and Flat Panel Display Applications"
Agent: National Science Foundation
Amount: **\$237,000** Period: 9/92-8/95 P.I.: D. W. Hess,
3. Title: "Acquisition of an Automated Digital Transmission Electron Microscope"
Agent: National Science Foundation
Amount: **\$709,300** Period: 6/96-8/99 P.I.: D. Smith
4. Title: "An Integrated Chemical Reforming Microplant for Fuel Cell Applications"
Agent: National Science Foundation
Amount: **\$533,000** Period: 11/99 – 10/02 P.I.: M. Kothare
5. Title: "Large Area Biosensing electronics"
Agent: National Science Foundation
Amount: **\$835,300** Period: 8/00 – 7/03 P.I.: D. W. Greve
6. Title: "Smart Microchemical Plant-on-Chip for High Performance Microscale Portable Power"
Agent: Pittsburgh Digital Greenhouse
Amount: **\$150,400** Period: 9/01 – 8/02 P.I.: M. Kothare
7. Title: "Acquisition of an Advanced Electron Lithography System"
Agent: National Science Foundation
Amount: **\$360,000** Period: 9/01 – 8/04 P.I.: M. White

SUPERVISION OF Ph.D. DISSERTATIONS

1. Fuyu Lin (1994) "Structural and Electrical Characteristics of Polycrystalline Semiconductors for Thin Film Transistor Applications"
Present Employment: Vice President, Great Wall Semiconductor
Previous: Motorola Semiconductors
2. Apostolos Voutsas (1994) "Low Temperature Deposition of Polycrystalline Silicon for Active Matrix Liquid Crystal Applications"
Present Employment: VP Business Development, Ares Materials Inc.
Previous: Director, Sharp Laboratories of America
3. Kola Olasupo (1994) "Physics and Technology of Submicron Polysilicon Thin Film Transistors."
Present Employment: Associate Professor, Prairie View A&M University
Previous: Director, AMD
4. Ji-Ho Kung (1994) "Effect of Gate Dielectric on Performance of Polysilicon Thin Film Transistors"
Present Employment: Associate Professor, National United University, Taiwan
Previous: ITRI
5. Greg Sarcona (1995) "Effects of Silicides and Device Structure on the Characteristics and Circuit Performance of Polysilicon Thin Film Transistors for Active Matrix Liquid Crystal Display"
Present Employment: Manager, BDNA Corp.
Previous: Western Digital
6. Sue Heng Lin (1995) "Physics, Technology and Characterization of Polysilicon Thin Film Transistors with Low Leakage Current Performance."
Present Employment: Principal Engineer NXP Semiconductors
Previous; Freescale Semiconductors
7. Mark Stewart (1999) "Polysilicon Devices for Large Area Electronics Applications: Organic Light Emitting Diode Displays and X-Ray Sensors."
Previous: Associate Professor, East Stroudsburg University
8. Robert Howell (2000) "Advanced Metallization and Applications to Large Area Active Matrix Arrays and Polysilicon Thin Film Transistors"
Present Employment: Northrop Grumman
9. Franklin Nkansah (2001) "Technology and Reliability of Sub-Micron 1T-Flash Electrically Erasable Programmable Read Only Memory (EEPROM)"
Previous: AMD
10. Suraj Karnik (2002) "Materials, Devices and Processes for Integrated Chemical Microsystems."
Present Employment: Cirrus Logic
Previous: Intel

11. Themis Afentakis (2004)
“Active Matrix Technology for Flexible Displays and Biosensors”
Present Employment: Sr. Engineer, Peratech Holdco Ltd.
Previous: Sharp Labs. of America
12. Sabrat Mukherjee (2006)
“Integrated Microchemical Systems for Processing Methanol Reformer Effluents for Portable Fuel Cell Applications.” Co-Advised with Prof. M. Kothare
13. Matias Troccoli (2006)
“TFT Circuits for Display and Large Electronics on Metal Foils.”
Present Employment: Vice President of Technology, Next Biometrics
14. Ta-Ko Chuang (2007)
“Active Matrix Organic Light Emitting Diode Displays on Flexible Metal Foil Substrates.”
Present Employment: Engineering Program Manager, Apple
Previous: Corning Inc.
15. Po-Chin Kuo (2009)
“Flexible electronics based on polysilicon TFTs on steel foil: Fabrication and characterization under strain.”
Present Employment: Samsung
Previous: TSMC
16. Abbas Jamshidi-Roudbari (2010)
“Polysilicon TFT Devices, Circuits, & Systems for Large Area Flexible Electronic Applications.”
Present Employment: Engineering Manager, Apple
17. Shahrukh Akbar Khan (2011)
“Amorphous Metal-Oxide based Thin Film Transistors on Metal Foils: Materials, Devices and Circuits Integration.”
Present Employment: Global Foundries
Previous: IBM
18. Nackbong Choi (2011)
“Metal Oxide Thin Film Transistors on Paper Substrate: Fabrication, Characterization and Printing Process.”
Present Employment: LG
19. Thomas Charisoulis (2014)
“Wide Bandwidth - High Accuracy Control Loops in the presence of Slow Varying Signals and Applications in Active Matrix Organic Light Emitting Displays and Sensor Arrays.”
Present Employment: Display Panel Engineer, Apple
20. Forough Mahmoudabadi (2016)
“Indium-Gallium-Zinc Oxide Thin-Film Transistors for Active-Matrix Flat-Panel Displays”