

# Vivek Subramanian

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## Education

3 / 96 - 6 / 98

### **Ph.D. in Electrical Engineering, Stanford University** *Stanford, California*

Honors earned: Graduate Fellowship, Eastman Kodak Company

9 / 94 - 3 / 96

### **MS in Electrical Engineering, Stanford University** *Stanford, California*

8 / 90 - 5 / 94

### **BS in Electrical Engineering, Louisiana State University** *Baton Rouge, Louisiana*

Honors earned: Summa cum laude, College Honors, Outstanding Senior, Junior and Sophomore, Honors College

## Professional Experience

2000 - present

### **Department of Electrical Engineering & Computer Sciences, University of California** *Berkeley, CA*

**7/11 – present: Professor**

**7/05 – 7/11: Associate Professor**

**7/00-7/05: Assistant Professor**

Research, teaching and service in EECS Department

#### **Honors Earned:**

2015 IEEE Kiyu Tomiyasu Award  
Best in session and best in track awards, 2013 IMAPS Microelectronics Conference  
Outstanding paper award, 2012 IMAPS Microelectronics Conference  
2008 Printed Electronics Champion, Printed Electronics USA Conference, November 2008  
Outstanding Teaching Award, EECS Department, UC Berkeley, 2005  
Best paper award, 2004 IEEE Device Research Conference  
Nominated to MIT's Technology Review top 100 young innovators list (TR100), 2002  
National Science Foundation Young Investigator (CAREER) Award, FY2002,  
Nominated to National Academy of Engineering's *Frontiers of Engineering*, 2002  
Winner of 2002 Paul Rappaport Award for best paper in an IEEE EDS Journal

2009 - present

### **Adjunct Professor, Sunchon National University** *Sunchon, Korea*

**2013 to date: Adjunct Professor, BK21 Program**

**2009-2013: Adjunct Professor and Principal Investigator, WCU Program**

*Initiated, managed, and contributed to large multinational research program focused on printed electronics, including displays, energy devices, and RFID*

2000 - present

### **Independent Consultant**

*Orinda, CA*

Consultant to the semiconductor industry and its associated fields in the following areas:

Memory technology and design, Silicon Process Technology  
Display / Imager and Flexible Electronics Technology, RFID Technology  
Intellectual Property Consulting  
Technology Evaluation / Venture Capital due diligence

2014- present

### **Founder and CTO, Dragonfly Technology Inc.**

*San Bruno, CA*

*Senior leadership role in venture-funded startup company working on wireless networking*

- 2004 – 2013 **Founding Scientific Advisor, Kovio, Inc.**  
*Sunnyvale, CA*  
*Scientific advising to printed electronics startup company*
- 2008 - 2011 **Chief Technical Advisor, QuSwami, Inc.**  
*San Francisco, CA*  
*Scientific advising to energy conversion device startup company*  
 Served as CTO from July 2010-June 2011
- 1998 - 2000 **Consulting Assistant Professor, Electrical Engineering Department, Stanford University.**  
*Stanford, CA*  
 Advisory role for research group of Prof. Krishna C. Saraswat
- 1998-2000 **Visiting Research Engineer, Electrical Engineering Department, University of California.**  
*Berkeley, CA*  
 Research into 25nm MOSFET technologies for giga-scale integration
- 1998 - 2000 **Founder, Matrix Semiconductor, Inc.**  
*Santa Clara, CA*  
 Co-founder and technical advisor of startup company working on high-density memory technology
- Honors Earned:**  
 Nominated to Scientific American's SA50 List for Visionary Technology  
 Finalist for 2003 World Technology Award for Information Technology Hardware  
 Winner, 2005 EDN Innovation Award
- 1998 **Co-instructor, Electrical Engineering Department, Stanford University.**  
*Stanford, CA*  
 Co-teaching of EE311, Advanced Integrated Circuit Fabrication Processes
- 1997 **Intern, Advanced Product Research and Development Laboratory, Motorola Inc.**  
*Austin, TX*  
 Research into process development issues affecting SiGe SEMFET devices
- 1996 **Head Teaching Assistant EE410: IC Fabrication Laboratory, Stanford University**  
*Stanford, CA*  
 Coordination and instruction of EE410, graduate level laboratory course.
- 1994-1998 **Research Assistant, Electrical Engineering, Stanford University**  
*Stanford, CA*  
 Research into crystallization of amorphous Si and SiGe films using low thermal budget processes.

### **Professional Affiliations and Activities**

Technical Program Committee, IEEE Electronic Components and Technology Conference, 2014 to date  
 Chair, Scientific Advisory Board, iPACK, Royal Institute of Technology (KTH), Sweden, 2011 to date  
 Tampere Institute of Technology Faculty Search Committee, Finland, 2013  
 University of Oulu Faculty Search Committee, Finland, 2013  
 Served as external thesis committee member for several universities world-wide, including University of Cape Town (South Africa), Tampere Institute of Technology (Finland), Technical University of Eindhoven (Netherlands), Indian Institute of Science (India), Indian Institute of Technology (India), 2009 to date  
 Associate Editor, IEEE Journal of Display Technology, 2008 to date  
 Technical Program Chair, Large Area, Organic, and Printed Electronics Conference, 2012-2013  
 Scientific Committee, Large Area, Organic, and Printed Electronics Conference, 2009-2011  
 Scientific Committee, International Conference on Printed and Flexible Electronics, 2009-2013  
 IEEE Electron Devices Society Organic Electronics Committee, 2003 - 2005  
 Executive Committee, International Electron Device Meeting, 2003 to 2009  
 Technical Program Committee, International Electron Device Meeting, 2001-2002  
 Technical Program Committee member, Device Research Conference, 2000-2002  
 Technical Program Committee member, VLSI-TSA Conference, 2005  
 Member, Institute of Electrical and Electronic Engineers

## List of Patents, Publications and Presentations

### Patents

1. “Wireless devices including printed integrated circuitry and methods for manufacturing and using the same”, P. Smith, C. Choi, V. Pavate, J. M. Cleeves, V. Subramanian, R. Young, V. Biviano, US Patent, 9,004,366.
2. “Dense arrays and charge storage devices “, T. H. Lee, V. Subramanian, J. M. Cleeves, M. G. Johnson, P. M. Farmwald, I. Kouznetzov, US Patent, 8,981,457.
3. “High reliability surveillance and/or identification tag/devices and methods of making and using the same”, V. Subramanian, P. Smith, V. Pavate, A. Kamath, C. Choi, A. Chandra, J. M. Cleeves, US Patent, 8,933,806.
4. “Surveillance devices with multiple capacitors”, P. Smith, C. Choi, J. M. Cleeves, V. Subramanian, A. Kamath, S. Molesa, US Patent, 8,912,890.
5. “Pillar-shaped nonvolatile memory and method of fabrication”, M. G. Johnson, T. H. Lee, V. Subramanian, P. M. Farmwald, J. M. Cleeves, US Patent 8,897,056
6. “Dense arrays and charge storage devices”, T. H. Lee, V. Subramanian, J. M. Cleeves, I. G. Kouznetzov, M. G. Johnson, P. M. Farmwald, US Patent 8,853,765
7. “Dense arrays and charge storage devices”, T. H. Lee, V. Subramanian, J. M. Cleeves, I. G. Kouznetzov, M. G. Johnson, P. M. Farmwald, US Patent 8,823,076
8. “Random delay generation for thin-film transistor based circuits”, V. Subramanian, M. Mao, Z. Wang, US Patent 8,810,298
9. “Vertically stacked field programmable nonvolatile memory and method of fabrication”, M. Johnson, T. Lee, V. Subramanian, M. Farmwald, and J. M. Cleeves, US Patent 8,503,215
10. “Process-variation tolerant series-connected NMOS and PMOS diodes, and standard cells, tags, and sensors containing the same”, V. Subramanian, P. Smith, US Patent 8,471,308
11. “Printed compatible designs and layout schemes for printed electronics”, Z. Wang, V. Subramanian, L. Cleveland, US Patent 8,383,952
12. “Method for making surveillance devices with multiple capacitors”, P. Smith, C. Choi, J. M. Cleeves, V. Subramanian, A. Kamath, S. Molesa, US Patent 8,296,943
13. “High reliability surveillance and/or identification tag/devices and methods of making and using the same”, V. Subramanian, P. Smith, V. Pavate, A. Kamath, C. Choi, A. Chandra, and J. M. Cleeves, US Patent 8,264,359
14. “High reliability surveillance and/or identification tag/devices and methods of making and using the same”, V. Subramanian, P. Smith, V. Pavate, A. Kamath, C. Choi, A. Chandra, and J. M. Cleeves, US Patent 8,227,320
15. “Vertically stacked field programmable nonvolatile memory and method of fabrication”, M. Johnson, T. Lee, V. Subramanian, M. Farmwald, and J. M. Cleeves, US Patent 8208282
16. “Reliable tag deactivation”, J. M. Cleeves, V. Subramanian, US Patent 8138921
17. “Combined static and dynamic frequency divider chains using thin film transistors”, V. Subramanian, US Patent 8085068
18. “Process-variation tolerant diode, standard cells including the same, tags and sensors containing the same, and methods for manufacturing the same”, V. Subramanian, P. Smith, US Patent 7932537
19. “Three terminal nonvolatile memory Device with vertical gated diode”, T. H. Lee, V. Subramanian, J. M. Cleeves, M. G. Johnson, P. M. Farmwald, I. G. Kouznetzov, US Patent 7825455
20. “Vertically stacked field programmable nonvolatile memory and method of fabrication”, V. Subramanian, J. M. Cleeves, US Patent 7816189
21. “Multi-mode tags and methods of making and using the same”, P. Smith, J. M. Cleeves, V. Pavate, V. Subramanian, US Patent 7750792
22. “Method of manufacturing complementary diodes”, V. Subramanian, P. Smith, US Patent 7528017
23. “Vertically stacked field programmable nonvolatile memory and method of fabrication”, V. Subramanian, J. M. Cleeves, US Patent 7319053

24. "Vertically stacked field programmable nonvolatile memory and method of fabrication", V. Subramanian, J. M. Cleeves, US Patent 7265000
25. "Vertically stacked field programmable nonvolatile memory and method of fabrication", V. Subramanian, J. M. Cleeves, US Patent 7160761
26. "Vertically stacked field programmable nonvolatile memory and method of fabrication", V. Subramanian, J. M. Cleeves, US Patent 7157314
27. "Dense arrays and charge storage devices", T. H. Lee, V. Subramanian, J. M. Cleeves, A. J. Walker, C. Petti, I. Kouznetzov, M. G. Johnson, P. M. Farmwald, B. Herner, US Patent 7129538
28. "Patterning three dimensional structures", C. K. Li, J. N. Knall, M. A. Vyvoda, J. M. Cleeves, V. Subramanian, US Patent 7071565
29. "Monolithic three dimensional array of charge storage devices containing a planarized layer", T. H. Lee, V. Subramanian, J. M. Cleeves, A. J. Walker, C. J. Petti, I. G. Kouznetzov, M. G. Johnson, P. M. Farmwald, and B. Herner, US Patent 6881994
30. "Vertically stacked field programmable nonvolatile memory and method of fabrication", M. G. Johnson, T. H. Lee, V. Subramanian, and P. M. Farmwald, US Patent 6780711
31. "Thermal processing for three dimensional circuits", V. Subramanian, J. M. Cleeves, J. N. Knall, C. K. Li, and M. A. Vyvoda, US Patent 6770939
32. "Multigate semiconductor device with vertical channel current and method of fabrication", J. M. Cleeves and V. Subramanian, US Patent 6677204
33. "Thermal processing for three dimensional circuits", V. Subramanian, J. M. Cleeves, J. N. Knall, C. K. Li, and M. A. Vyvoda, US Patent 6624011
34. "Multigate semiconductor device with vertical channel current and method of fabrication", J. M. Cleeves and V. Subramanian, US Patent 6580124
35. "Patterning three dimensional structures", C. K. Li, J. N. Knall, M. A. Vyvoda, J. M. Cleeves, and V. Subramanian, US Patent 6627530
36. "Low cost three-dimensional memory array", M. Johnson, T. Lee, V. Subramanian, P. Farmwald, J. Knall, US Patent 6515888
37. "Integrated circuit structure including three-dimensional memory array", M. Johnson, T. Lee, V. Subramanian, P. M. Farmwald, J. M. Cleeves, US Patent 6385074.
38. "FINFET transistor structures having double gate channel extending vertically from a substrate and methods of manufacture", C. Hu, T-J. King, V. Subramanian, L. Chang, X. Huang, Y-K. Choi, J. T. Kedzierski, N. Lindert, J. Bokor, W-C. Lee, US Patent 6413802
39. "Vertically stacked field programmable nonvolatile memory and method of fabrication", M. Johnson, T. Lee, V. Subramanian, M. Farmwald, and J. M. Cleeves, US Patent 6185122.
40. "Vertically Stacked Field Programmable Nonvolatile Memory and Method of Fabrication", M. Johnson, T. Lee, V. Subramanian, M. Farmwald, and J. M. Cleeves, US Patent 6034882.
41. "Vertically Stacked Field Programmable Nonvolatile Memory and Method of Fabrication", M. Johnson, T. Lee, V. Subramanian, M. Farmwald, and J. M. Cleeves, US Patent 6351406.
42. "Vertically Stacked Field Programmable Nonvolatile Memory and Method of Fabrication", M. Johnson, T. Lee, V. Subramanian, M. Farmwald, and J. M. Cleeves, US Patent 6483736.

#### **Invited Magazine Articles, Books, Chapters, and Monographs**

1. Chapter in "Inkjet Technology for Digital Fabrication", Editors: Ian M. Hutchings, Graham D. Martin, Wiley, ISBN: 978-0470681985
2. Chapter in "Applications of Organic and Printed Electronics: A Technology-Enabled Revolution (Integrated Circuits and Systems), Editor: E. Cantatore, ISB: 978-1-461-43159-6
3. Chapter in "Inkjet-based Micromanufacturing", Editors: Korvink, Smith, Shin, Wiley, ISBN: 978-3-527-31904-6

4. Chapter in "Organic Electronics II. More Materials and Applications", Editor: H. Klauk, Wiley, ISBN: 978-3-527-32647-1
5. Chapter in "Transparent Electronics: From Synthesis to Applications", Editors: A. Facchetti and T. Marks, Wiley, ISBN: 978-0-470-99077-3, 2010.
6. Chapter in "The chemistry of inkjet inks", Editor: S. Magdassi, World Scientific Publishing Company, ISBN: 978-9812818218, 2009
7. Chapter in "Organic Field-Effect Transistors", Editors: Z. Bao, and J. Locklin, CRC Press, ISBN: 978-0849380808, 2007
8. "Developments in printed RFID", V. Subramanian, Pira Publishing, UK, 2006.
9. "3D Chips: Future Possibilities", V. Subramanian, Silicon India, Feb 2003, pp. 24-25

#### **Invited Conference Presentations**

1. **Plenary**, "Printed Electronics: Advanced Technologies Enabling New Applications", 2015 Flexible and Printed Electronics Conference, Monterey, CA, February 23-26, 2015.
2. **Invited**, "High-resolution gravure printing of organic thin film transistors for high-performance printed electronic systems", V. Subramanian, R. Kitsomboonloha, J. Cen, H. Kang, G. Grau, and W. J. Scheideler, Materials Research Society Fall Meeting, Boston, MA, Dec 3, 2014.
3. **Invited**, "Advanced printed electronics technologies for novel ubiquitous human interactive systems", 2014 CMOS Emerging Technologies Research Symposium, Grenoble, France, July 6-8, 2014.
4. **Invited**, "Printed Electronics: A pathway to functionally-rich systems", 64<sup>th</sup> annual IEEE Electronic Components and Technology Conference, Orland, FL, May 27, 2014.
5. **Invited**, "Printed Electronics: The Confluence of Printing and Semiconductors", Canadian Printed Electronics Symposium, Montreal, Canada, April 9, 2013.
6. **Invited** "Modeling, scaling, and integration of gravure printing for fast switching Organic FETs", V. Subramanian, S. J. S. Morris, H. Kang, Materials Research Society Fall 2012 Meeting, Boston, MA, Nov 25-30, 2012
7. **Invited**, "Printed Nanoparticles as routes to high-performance printed conductors: Synthesis, Printing Processes, and Device Applications", V. Subramanian, H. Kang, R. Kitsomboonloha, and S. K. Volkman, The 2012 International Conference on Flexible and Printed Electronics ICFPE2012, Tokyo, Japan, September 6th - 8th, 2012
8. **Invited** "Advanced Printing Processes for High-Performance Printed Transistors", V. Subramanian, Flextech Workshop on Printing Electronics - Ink and Substrate Interactions, Kalamazoo, MI, August 1-2, 2012
9. **Invited** "High-performance Printed Transistors: Materials, Processes, and Devices", V. Subramanian, 2nd CPEM International Symposium "Organic Semiconductors and Printed Electronics", Gyeonggi, South Korea, May 10th, 2012.
10. **Invited** "Highly-Scaled Gravure and Inkjet Printed Organic Transistors: Tools, Processes, and Devices", Hongki Kang & Vivek Subramanian, 2012 Flextech Flexible Electronics and Display Conference, Phoenix, AZ, Feb 5-9, 2012.
11. **Plenary** "Nanomaterials for printed electronics: synthesis, design, and applications", V. Subramanian, International Conference on Nano Science and Nano Technology, Sunchon, Korea, November 11<sup>th</sup>, 2011.
12. **Invited** "Advances in scaling of printed transistors", V. Subramanian, International Seminar on Printed Electronics, Seoul, Korea, June 8<sup>th</sup>, 2011.
13. **Invited** "High-Performance Fully Printed Transistors: Materials, Processes, and Device Characteristics", V. Subramanian, H. Tseng, R. Kitsomboonloha, and A. de la Fuente Vornbrock, 2011 Electrochemical Society Meeting, Montreal, Canada, May 2011
14. **Invited** "From Droplets to Devices: Printed Transistor Processes, Integration, and Characteristics", Vivek Subramanian, Daniel Soltman, Huai-Yuan Tseng, Rungrot Kitsomboonloha and Alejandro de la Fuente Vornbrock, Materials Research Society Spring Meeting, San Francisco, CA, April 2011
15. **Keynote** "Printed electronics: Innovations in tools, materials, devices, and applications", V. Subramanian, 2011 Korea Printed Electronics Association (KoPeA) meeting, Seoul, Korea, March 2011
16. **Keynote** "Printed RF tags and sensors: the confluence of printing and semiconductors", V. Subramanian, F. Liao, and H-Y. Tseng, The European Microwave Integrated Circuits Conference 2010, Paris, France, September 2010.

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