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NANOTECHNOLOGY COUNCIL

IEEE*nano*CON-2016: *Inspiring the Next Generation*

Three Day Workshop on Nanotechnology
June 13 – 15, 2016

Presented by the IEEE SFBA Nanotechnology Council Chapter

Sponsored by OCSiAL USA, IBM & IEEE SCV Section

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IEEE*nano*CON-2016: *Inspiring the Next Generation*

AGENDA

Day 1 June 13, 2016 Texas Instruments Auditorium E-1, 2900 Semiconductor Drive, Santa Clara, CA

9:00	Registration and networking
9:30	Introduction
9:40	Dr. Meyya Meyyappan, Chief Scientist NASA AMES Research Center Nanomaterials and their Applications in Electronics and Sensor Development
10:40	Break – Networking
11:00	Dr. Jeffrey Wong, Chief Scientist, CA Dept of Toxic Substances Control. Real World Concerns about Nanomaterials in Consumer Products
12:00	Lunch - Networking
1:00	Prof. Wei Wu, Prof Electrical Engineering, University of Southern California Nanoimprint Lithography Science and Applications
2:00	Break - Networking
2:20	Dr. Konstantin Tikhonov, VP Energy Applications, OCSiAl The Promise & Progress Single Walled Carbon Nanotubes
3:20	Prof. Folarin Erogbogbo, Prof Biomedical Engineering San Jose State University NanoBioMed Science and Applications
4:20	Work life panel (Above speakers) – Finding and doing jobs in nanotechnology

Day 2 June 14, 2016 IBM Almaden Research Center 650 Harry Road, San Jose, CA

9:00	Registration and Networking & Breakfast provided by IBM
9:30	Introductions
9:40	Dr. Spike Narayan – Innovation at the Intersection of Nano and XYZ
10:40	Break - Networking
11:00	Dr. Jeannette Garcia IBM Almaden, Sustainable Polymers
12:00	Lunch - Networking
1:00	Prof. Alex Zettl, UCB – Nanomaterials and Devices
2:00	Dr. Vasuda Bhatia **–** Nanomaterials in Chemical, Gas and BioSensing
3:00	Break - Networking
3:20	Prof. Michael McGehee, Stanford - Perovskite solar cells & startups
4:20	Internships - Luisa Bozano, IBM

Day 3 June 15, 2016 Paul Allen Building Stanford University Room 101X

9:00	Registration and networking
9:30	Introductions
9:40	Prof. Yoshio Nishi & Dr. Blanca Magyari-Kope Emerging nonvolatile memory materials and devices
10:40	Break - Networking
10:55	Prof. Mark Brongersma, Materials Science and Engineering, Stanford Semiconductor Nanowire Nanophotonics and Optoelectronics
11:55	Lunch- networking – Nanofabrication facility tour
1:00	Dr. Jay Rajadas – Nanotechnology Enabled Medical Technology
2:00	Dr. Kayte Fischer, CTO Nano Precision Medical Inc. Harnessing Nano for Drug Delivery
3:00	Break - Networking
3.15	Prof. Arun Majumdar, The Jay Precourt Professor at Stanford University Role of nanoscale materials and devices in transforming our energy system
4:15	Jan Thoren, Founder NanoArchitech. - Architectural Supermaterials
5:00	Closing remarks.

"Nanomaterials and their Applications in Electronics and Sensor Development"

Dr. Meyya Meyyappan

Nanomaterials such as carbon nanotubes and graphene have been explored for a variety of applications due to their intriguing properties. In this talk, our efforts at NASA Ames to develop chemical and biosensors using CNTs will be described. Wearable/flexible electronics is another area that can benefit from nanomaterials in the construction of memory devices and sensor systems. This talk will provide an overview of the nanoelectronics applications enabled by nanomaterials.

Dr. Meyya Meyyappan is Chief Scientist for Exploration Technology at NASA's Ames Research Center in California's Silicon Valley. Until June 2006, he served as the director of the Center for Nanotechnology at Ames. He also is a founding member of the Interagency Working Group on Nanotechnology (IWGN) established by the Office of Science and Technology Policy in Washington, D.C. The IWGN is responsible for developing the National Nanotechnology Initiative. He has authored or co-authored more than 325 articles in peer-reviewed journals, given more than 200 seminars at universities, and presented more than 250 Invited/Keynote/Plenary Talks on nanotechnology subjects around the world. His research interests include carbon nanotubes, graphene, and various inorganic nanowires, their growth and characterization, and application development in chemical and biosensors, instrumentation, electronics and optoelectronics.

Dr. Meyyappan is a Fellow of the IEEE, ECS, AVS, MRS, AIChE, ASME, National Academy of Inventors, and the California Council of Science and Technology. He is currently the IEEE Electron Devices Society (EDS) Distinguished Lecturer, and was the Distinguished Lecturer on Nanotechnology for both the IEEE Nanotechnology Council and ASME. For his contributions and leadership in nanotechnology, he has received numerous awards including a Presidential Meritorious Award; NASA's Outstanding Leadership Medal; Arthur Flemming Award given by the Arthur Flemming Foundation and the George Washington University; IEEE Judith Resnick Award; IEEE-USA Harry Diamond Award; AIChE Nanoscale Science and Engineering Forum Award; Distinguished Engineering Achievement Award by the Engineers' Council; Pioneer Award in Nanotechnology by the IEEE-NTC; Sir Monty Finniston Award by the Institution of Engineering and Technology (UK); Outstanding Engineering Achievement Merit Award by the Engineers' Council; IEEE-USA Professional Achievement Award; AVS Nanotechnology Recognition Award; IEEE Nuclear and Plasma Sciences Society Merit Award. For his sustained contributions to nanotechnology, he was inducted into the Silicon Valley Engineering Council Hall of Fame in 2009. He received an Honorary Doctorate in 2015 from the University of Witwatersrand in South Africa.

“Real World Concerns about Potential Hazards of Nanomaterials in Consumer Products”

Dr. Jeffrey Wong

Chief Scientist and Deputy Director for Science, Pollution Prevention and Technology (ret.)
Safer Products and Workplaces Program, Department of Toxics Substances Control, California Environmental Protection Agency

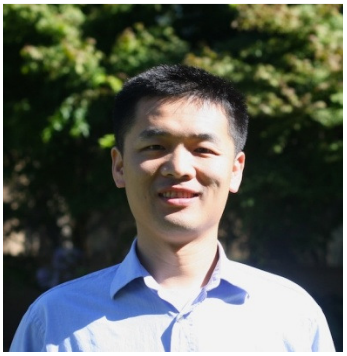
The California Safer Consumer Products Regulations (SCPR) provides a continuous, science-based, iterative process to identify safer consumer product alternatives. Nanomaterials can be subject to these regulations either as chemicals or products. There are various features of the SCPR that allow for a more precautionary approach to the regulation of new or emerging products and chemicals, such as nanomaterials and nanomaterial enabled products, than that found in past regulatory frameworks. Manufacturers and others who are involved in the lifecycle of a nanomaterial will want to develop or obtain safety and other relevant data prior to introduction of a nanomaterial or nanomaterial enabled product to the marketplace. The SCPR will provide new opportunities for scientists who contribute not only to the performance design of nanomaterial enabled products, but also for those needed for the design of safe nanomaterial enabled products (from manufacturing to end-of-life).

Dr. Wong previously served as the Deputy Director of Science, Pollution Prevention and Green Technologies and the Chief Scientist for the California Department of Toxic Substances Control (DTSC) at the California Environmental Protection Agency in Sacramento, California. For more than 25 years, he managed DTSC’s efforts in the areas of environmental measurements, biological and exposure monitoring, toxicology and risk assessment, pollution prevention and technologies. He has led efforts focused on nanotechnologies, emerging contaminants and green chemistry and worked from the beginning on DTSC’s Green Chemistry Initiative and Safer Consumer Products Regulation.

Prior to this, Dr. Wong was involved in forensic sciences for law enforcement.
Dr. Wong has served on Study Committees for the National Academy of Sciences, the U.S. Environmental Protection Agency and U.S. Department of Energy. He has also worked in areas related to the management and disposal of nuclear materials by appointment of President William J. Clinton. Dr. Wong did his graduate work at the University of California, Davis.

Currently, Dr. Wong is advising on specialized scientific and regulatory policy issues and strategies related to toxicology, exposure and risk for DTSC’s Safer Products and Workplaces Program.

“Nanoimprint Lithography and Applications”



Dr. Wei Wu

Professor, Department of Electrical Engineering-Electrophysics at University of Southern California

Nanoimprint lithography is a cost-effective nano-patterning technology based on the mechanical deformation of a resist rather than locally changing the resist chemically by radiation. It is capable of high-resolution, large-area, high-throughput and low-cost patterning. Moreover, it can be used to pattern 3D nanostructures and on non-flat and flexible substrate. After 20 years of fast growth, great progress has been made. Nanoimprint lithography has grown from a “smart invention” to a technology on the ITRS roadmap and with applications much beyond semiconductors. To demonstrate the capability of NIL, I will present two applications as examples. One is a color reflective display technology based on nanophotonics, and the other is chemical sensing devices based on plasmonic nanostructure. Both applications are enabled by NIL

Wei Wu graduated from Peking University with a BS in Physics in 1996, and received a Ph.D. in Electrical Engineering from Princeton University in 2003. He joined the Ming Hsieh Department of Electrical Engineering at the University of Southern California as an associate Professor January, 2012.

Before joining USC, he had worked as research associate, scientist and senior scientist at HP labs. His work includes the first nanoimprint-fabricated optical negative index meta-material at 1.55 micron range, the first optical modulation using negative index meta-material at near-IR, the first third harmonic generation using meta-material, crossbar memory (i.e. memristor) and logic circuits with the record high densities, highly sensitive surface enhanced Raman sensors fabricated using 3-D nanoimprint, the first room-temperature working single electron memory and the first large area bit-patterned magnetic media fabricated using nanoimprint. He coauthored 92 peer reviewed journal papers, 2 book chapters and more than 100 conference presentations, including 15 keynote and invited presentations. He has 88 granted US patents and 29 pending applications. Half of them were also filed internationally. He is a co-editor of *Applied Physics A* and an associate editor of *IEEE Transactions on Nanotechnology*. He is also an IEEE nanotechnology council 2015 and 2016 distinguished lecturer and recipient of *Nanoimprint Pioneer Award* by Nanoimprint and Nanoprinting Technology (NNT) conference in 2015.

“The Promise and Progress of SWCNTs”

Dr. Konstantin Tikhonov

Vice President of OCSiAl LLC

OCSiAl is the largest commercial manufacture in the world of high quality single wall carbon nanotubes known under brand name TUBALL™.

During our presentation we will discuss properties of the nanotubes, and share our experience introducing SWCNTs into a variety of products including plastics, resins, rubber, epoxies and battery electrodes. SWCNTs enable conductivity as well as mechanical reinforcement to materials at concentrations below 0.1%. In energy field, SWCNT are replacing carbon black to enhance energy density and cycle life of Li-ion and lead acid batteries. In addition, OCSiAl explores applications of nanotubes in supercapacitors, primary cells and fuel cells. Combination of low percolation threshold, relatively low surface area and high length to diameter ratio bring benefits to the frontier of lithium ion cells: high voltage cathodes and silicon anode development.

In our presentation we will share our findings about fundamental SWCNT properties, application examples and outline future directions and products that will benefit from use of SWCNTs.

Konstantin Tikhonov is a Vice President of OCSiAl LLC and is leading SWCNT-based product development effort in energy applications. Konstantin spent most of the last 20 years working on nanomaterials, battery electrolytes, ionic liquids and applied research in energy field developing lithium and Li- ion cells.

“Nanomedicine in the 21st Century”

Dr. Folarin Erogbogbo

Professor, Biomedical Engineering at San Jose State University

Nanomaterials are materials controlled by manipulation of size and shape at the nanometer scale (atomic, molecular, and macromolecular scale) that produce structures, devices, and systems with at least one novel/superior characteristic or property. There is generally excitement when a superior property of materials on the nanoscale that can revolutionize the world are discovered, however undesirable properties (such as toxicity or inefficiency) can dim their prospects of real world applications. This seminar will focus on addressing nanomaterial challenges related to health care. This talk will highlight innovative approaches to creating and understanding nanomaterials for healthcare (cardiovascular disease, diabetes, tuberculosis, and cancer).

Upon receiving his B.S in Chemical Engineering, Prof. Erogbogbo stayed on as a National Science Foundation IGERT Fellow to pursue a graduate degree in Chemical and Biological Engineering at University at Buffalo (SUNY) with Professor Mark Swihart. He then moved to the Institute for Lasers Photonics and Biophotonics and served as a Ford Fellow with Professor Paras N. Prasad. He has published multiple high impact peer reviewed articles on nanoplatforms for biomedical applications. He has won numerous awards for his research and mentoring work. Professor Erogbogbo joined the SJSU faculty in the summer of 2013 as an Assistant Professor in the Biomedical, Chemical and Materials Engineering Department. His research focuses on scalable synthesis of biocompatible nanomaterials for biomedical applications.

“Innovation at the Intersection of Nano and XYZ”

Dr. Spike Narayan

Director of Science and Technology Organization, IBM Research, Almaden.

The talk will explore the importance of multi-disciplinary research that is key to radical innovation. The role of nanotechnology and nanoscience is at the core of materials innovation and examples of the challenges involved will be outlined. Examples of materials breakthroughs will be offered. The importance of probing at the nanoscale will be elaborated. Finally, the importance of multidisciplinary education will be stressed.

Dr. Chandrasekhar (Spike) Narayan presently heads the Science and Technology Organization at IBM Research - Almaden. He is responsible for driving both fundamental and applied research in areas that include nanoscale science and engineering, nanoscale device integration, spin based electronics, advanced materials development and characterization, storage technologies and computational materials science. He is also responsible for driving new programs in the areas water, energy, environment and health care.

Previously, Dr. Narayan has held several research and management positions in both Almaden and Watson Research Laboratories and has received many awards for his technical contributions. In addition, he is a Master Inventor within IBM Research and has over 50 US Patents to his credit. In addition, Dr. Narayan has contributed to the external engineering community by serving as the general and program chair for the IEEE/IEMT Symposium in 1999 and 2000, respectively, and chaired the DRAM Development Alliance Invention Board in 1999.

Dr. Narayan earned his Bachelor of Technology in Metallurgy from Indian Institute of Technology, a Master of Science and a PhD in Metallurgy and Materials Engineering from Lehigh University.

“Sustainable Polymers - Global Impact to Humanity through a New Class of Materials”

Dr. Jeannette M. Garcia

Research Staff Member, IBM Almaden Research Center

Poly(hexahydrotriazine)s (PHTs) represent a class of synthetically tunable and dynamic materials that exhibits broad scope in thermal and mechanical properties. Depending on monomer choice, these thermosets can range from elastomeric and self-healing to strong and brittle. Highly crosslinked thermosetting networks such as these have limited solubility in organic solvents; thus, solid-state analysis was coupled with in silico methods to characterize structure-property relationships. Density functional theory (DFT) on small-molecule model systems and molecular dynamics (MD) simulations on network-formation provided a rationale for observed properties and guided ensuing experiments. This talk will focus on the combination of experimental efforts with computational analysis to develop and design new polymeric materials with targeted properties.

Dr. Jeannette Garcia is a polymer chemist at IBM Research – Almaden. Her research is focused on the rational design of new polymers and materials through sustainable methods, and targeting recyclable materials with mechanical and thermal properties in combinations not previously accessible. Her interests are centered in chemistries for improvement of the environment and human health. Upon joining IBM in 2012 as a postdoctoral researcher, Dr. Garcia worked with Dr. Jim Hedrick on recyclable polymers. After her promotion to Research Staff Member in 2013, she initiated a program in high-performance materials, energy storage and polymer recycling. From this emerged the team’s discovery of a new class of industrial polymers, which can potentially be used as printable materials (3D printing), structural composites, cargo carriers, adhesives and sealants. Her team also discovered a mechanism for using discarded drink bottles to create high-performance materials and designed a low cost, portable detection system for the detection and removal of toxic heavy metals in drinking water.Dr. Garcia received her B.S. from Seattle University and Ph.D. in Chemistry at Boston College under the guidance of Dr. Amir H. Hoveyda, where she focused on developing catalysts for small molecule production. Dr. Garcia is one of MIT Tech Review’s 2015 35 Innovators Under 35, one of Business Insider’s 17 IBM Research Rock Stars, and the recipient of the Individual World Technology Award in Materials. She has authored over 20 papers, has over 60 patents pending and is an IBM Master Inventor. Her work has been featured in The New York Times, Wall Street Journal and Scientific American.

"Nanomaterials and Devices"

Dr. Alex Zettl

Professor of Physics, University of California Berkeley

Nanomaterials formed from sp2-bonded carbon or boron-nitride have exciting structural, electronic, and optical properties that may find useful application for sensors, energy transducers, structural reinforcements, and biology/medicine. I will discuss methods to synthesize the nanomaterials, characterize them at the atomic scale, and construct unique devices from them, including nanoscale electric motors, radio receivers, single-atom mass sensors, bio-injectors, and liquid cells for transmission electron microscopy.

Alex Zettl received his B.A. from UC Berkeley in 1978 and his Ph.D. from UCLA in 1983. He joined the Physics Department faculty at UC Berkeley in 1983. Currently he is Professor of Physics at UC Berkeley and Senior Scientist at LBNL. Awards and Honors include Presidential Young Investigator Award (1984-89), Sloan Foundation Fellowship (1984-86), IBM Faculty Development Award (1985-87), and Miller Professorship (1995), Lucent Technologies Faculty Award (1996), Fellow of the American Physical Society (1999), Lawrence Berkeley National Laboratory Outstanding Performance Award (1995 and 2004), R&D 100 Award (2004), James C. McGroddy Prize for New Materials (2006), Miller Professorship (2007)

“Electrostatic Functionalization of Carbon Based Nanomaterials and Applications in Chemical, Gas and BioSensing”

Dr. Vasuda Bhatia

Lead Scientist at Amity Institute of Renewable and Alternative Energy and Amity Institute of Advanced Research and Studies, Amity University, India

Nanosensors can be categorized based on the dimensions of the nanomaterials, i.e. 0-D structures that include nanoparticles and quantum dots, 1-D structures including nanowires and nanotubes, 2-D structures include thin films, planar quantum wells and superlattices, and 3-D structures such as bulk nanomaterials with crystalline, polycrystalline and amorphous materials.

In this talk, emerging nanosensor technologies for biomolecular recognition and chemical molecule analysis will be discussed based on the structures of nanomaterials. Overview of properties and fabrication methods of nanomaterials will be provided. Examples of molecularly modified metal nanoparticles for DNA and biomolecule detection will be discussed. Applications of quantum dots for chemical and bio sensing will be described. We will also discuss gas sensing properties of chemically modified Silicon nanowires (Si NW) based Field Effect Transistors. Recently, applications based on carbon nanotubes (CNTs) have peaked in interest in research and industry due to their unique combination of properties related to high stiffness, strength and thermal and electrical conductivity compared to other nanomaterials. A detailed overview of sensing applications for CNTs and other allotropes of carbon nanomaterials will also be provided.

Vasuda Bhatia is a Lead Scientist at Amity Institute of Renewable and Alternative Energy and Amity Institute of Advanced Research and Studies, Amity University, India. She received her B.Tech. (Bachelors of Technology) in Materials and Metallurgical Engineering from Indian Institute of Technology (IIT) Kanpur, India in 1995, MS in Materials Science from the University of Cincinnati in 1997 and the Ph.D. in Electrical Engineering from Texas A&M University in 2001. She was research scientist at Stellar Micro Devices, Austin, Texas; visiting faculty at IIT Kanpur, India and research associate at Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, India. Her research interests include synthesis, characterization and device applications of nanomaterials; materials for renewable energy applications; field emission devices and materials and development of sensors and sensing devices for bio, chemical and gas applications.

"Perovskite solar cells, smart windows and startups."

Dr. Michael McGehee

Professor of Materials Science and Engineering, Stanford University

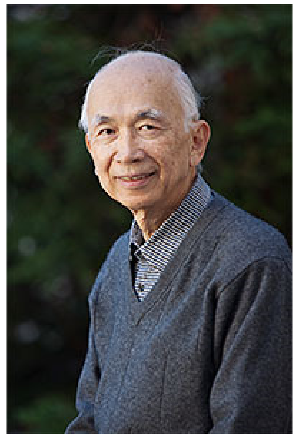
The efficiency of metal-halide perovskite solar cells has soared from a few percent to over 20% in the last 3 years. They are very attractive for multijunction solar cell applications because the bandgap of metal-halide perovskite semiconductors can be easily tuned in the range of 1.5 to 2.3 eV and the open circuit voltage of the cells is large, allowing for tandems with Si or CIGS that exceed 30% efficiency. The perovskite and surrounding active layers consist of inexpensive, solution-processable materials, allowing for both a low capital expenditure intensity as well as a low product manufacturing cost.

In this presentation, I will discuss our efforts at designing and fabricating both mechanically-stacked and monolithic tandems. First; the design of transparent electrodes given the processing restrictions of the perovskite and the results of mechanically-stacked and monolithic tandems made with these transparent electrodes. Then; how we have extended the function of the transparent electrode to stabilize the perovskite under constant illumination for ~1000hrs. Finally; our efforts at mitigating some of the stability issues of the perovskite by altering the perovskite chemistry to include cesium.

Michael D. McGehee is a Professor in the Materials Science and Engineering Department and a Senior Fellow of the Precourt Institute for Energy. His research interests are developing new materials for smart windows and solar cells. He has taught courses on nanotechnology, nanocharacterization, organic semiconductors, polymer science and solar cells. He received his undergraduate degree in physics from Princeton University and his PhD degree in Materials Science from the University of California at Santa Barbara, where he did research on polymer lasers in the lab of Nobel Laureate Alan Heeger. He won the 2007 Materials Research Society Outstanding Young Investigator Award. He is a technical advisor to Next Energy, PLANT PV, and Sinovia and his former students have started more than ten companies.

“Emerging Nanoscale Nonvolatile Memory Devices”

“Progress in Metal Oxide Resistance Change Memory”



Dr. Blanka Magyari Kope and Dr. Yoshio Nishi

Department of Electrical Engineering, Stanford University

Resistive random-access memory (RRAM), one of the most promising candidates for next generation non-volatile memory technology, nowadays still faces a series of challenges including switching-parameter variability, cycling endurance, and data retention. In order to cope with these challenges, ionic doping techniques have been widely explored to achieve better performance and reliability, through fine-tuning the switching material properties. The major factors that potentially affect the forming characteristics of doped transition metal oxides were systematically evaluated with density functional theory (DFT) calculations in conjunction with experimental observations to address the opportunities and challenges in achieving tunable RRAM characteristics.

Blanka Magyari-Köpe received her Ph.D. degree in Physics from the Royal Institute of Technology, Stockholm, Sweden, in 2003. Since 2006, she has been an Engineering Research Associate and from 2011 a Senior Research Engineer in the Department of Electrical Engineering at Stanford University. Prior to this position she was a postdoctoral researcher in the Department of Materials Science and Engineering, University of California, Los Angeles.

Her research interests include adapting and applying high-precision, accurate, and efficient quantum mechanical modeling to real applications. She had been working on the analysis and fundamental understanding of electronic properties of novel and technologically relevant materials, i.e. perovskites, metal alloys, hydrogen storage materials, metal gate/high-k MOS structures and RRAM device materials. Currently, she is involved in projects that involve understanding the RRAM switching mechanism and the role and control of nanointerfaces between metallic, insulating, and semiconducting materials, seeking solutions to design and manipulate them at the atomic level in order to achieve increased performance of electronic devices. Dr. Magyari-Köpe is a member of the American Physical Society (APS), Materials Research Society (MRS), Institute of Electrical and Electronics Engineers (IEEE) and Electrochemical Society (ECS). She received a Swedish Institute Fellowship in 1997. She has given over 30 invited talks and has published more than 80 scientific papers.

Yoshio Nishi is a professor in the Department of Electrical Engineering (research) at the Stanford University since May 2002. He also served as the director of the Stanford Nanofabrication Facility of National Nanotechnology Infrastructure Network of the United States and director of research of the Center for Integrated Systems, and currently Chairman of the Stanford SystemX Alliance. He received a BS degree in materials science and a PhD in electronics engineering from Waseda University and the University of Tokyo, respectively.

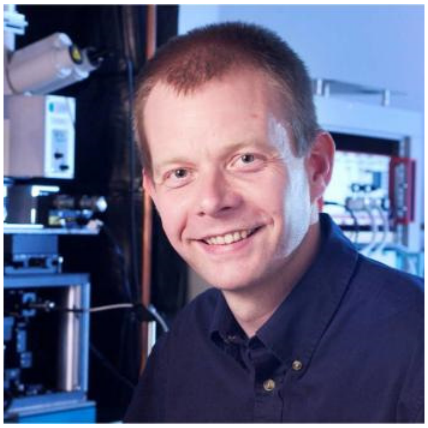
He researched semiconductor device physics and silicon interfaces in the Toshiba R&D, which resulted in the discovery of ESR PB Center at SiO_2–Si interface, the first 256-bit MNOS nonvolatile RAM, SOS 16-bit microprocessor, and the world's first 1-MB CMOS DRAM. In 1986 he joined Hewlett-Packard as the director of the Silicon Process Lab, and then established the ULSI Research Lab. Dr Nishi joined TI, Inc. in 1995 as the senior vice president and the director of R&D for the semiconductor group, implemented a new R&D model for silicon technology development, and established the Kilby Center.

In May 2002 he became a faculty member at the Stanford University and his research interest covers nanoelectronic devices and materials including a metal gate/high-k MOS, a device layer transfer for 3D integration, nanowire devices, and resistance change nonvolatile memory materials and devices. He has published more than 250 papers including conference proceedings, and he coauthored/edited ten books. He holds more than 70 patents in the United States and Japan.

Dr. Nishi is a life fellow of the IEEE, a fellow international of the Japan Society of Applied Physics and the Electrochemical Society. His recent awards include the 1995 IEEE Jack Morton Award and the 2002 IEEE Robert Noyce Medal, 2008 SEMI Lifetime Achievement Award.

Dr. Nishi is a fellow of the IEEE, a member of the Japan Society of Applied Physics and the Electrochemical Society. His recent awards include the 1995 IEEE Jack Morton Award and the 2002 IEEE Robert Noyce Medal.

“Semiconductor Nanowire Nanophotonics and Optoelectronics”



Dr. Mark Brongersma

Professor of Materials Science and Engineering, Stanford University

Many conventional optoelectronic devices consist of thin, stacked films of metals and semiconductors. In this presentation, I will demonstrate how one can improve the performance of such devices by nano-structuring the constituent layers at length scales below the wavelength of light. The resulting metafilms and metasurfaces offer opportunities to dramatically modify the optical transmission, absorption, reflection, and refraction properties of device layers. This is accomplished by encoding the optical response of nanoscale resonant building blocks into the effective properties of the films and surfaces. To illustrate these points, I will show how nanopatterned metal and semiconductor layers may be used to enhance the performance of solar cells, photodetectors, and enable new imaging technologies. I will pay specific attention to devices built up from dense arrays of semiconductor nanowires

Mark Brongersma is a Professor and Keck Faculty Scholar in the Department of Materials Science and Engineering at Stanford University. He leads a research team of ten students and four postdocs. Their research is directed towards the development and physical analysis of new materials and structures that find use in nanoscale electronic and photonic devices. His most recent work has focused on Si-based light-emitting materials, light sources, modulators, detectors, and metallic nanostructures that can manipulate and actively control the flow of light at the nanoscale. He has authored\co-authored over 175 publications, including papers in Science, Nature Photonics, Nature Materials, and Nature Nanotechnology. He also holds a number of patents in the area of Si microphotonics and plasmonics. He received a National Science Foundation Career Award, the Walter J. Gores Award for Excellence in Teaching, the International Raymond and Beverly Sackler Prize in the Physical Sciences (Physics) for his work on plasmonics, and is a Fellow of the Optical Society of America, the SPIE, and the American Physical Society.

Dr. Brongersma received his PhD in Materials Science from the FOM Institute in Amsterdam, The Netherlands, in 1998. From 1998-2001 he was a postdoctoral research fellow at the California Institute of Technology.

“Hard and soft corona forming nanoparticles and their biomedical applications”

Dr. Jayakumar Rajadas

Director, BioADD and Assistant Director of CV Pharmacology, BioADD Service Center, Stanford University Medical School

Pre-designed soft nanosomes and metal-based hard nanosomes, protein, carbohydrates and lipids, accrete coronal structures of desired patterns by accumulating proteins, lipids and carbohydrates present in biological fluids. We have shown patterned corona recognize blood capillary endothelial linings proximal to affected tissues in the heart, brain, and liver. These nanosomes stabilize fragile, therapeutic peptides and proteins, and target their delivery, along with water insoluble molecules, to affected tissue.

Dr. Rajadas's research focuses on developing nano formulations to treat the diseases concerning neuro and peripheral inflammation. He has developed CryAB, TLR2 tolerizing agent as therapeutic molecules for Multiple sclerosis. He has authored over 182 peer-reviewed journal articles including publications in Nature Medicine, Molecular Cell, Journal of Clinical Investigation, and the Proceedings of the National Academy of Sciences (USA). As the founding Director of the Biomaterials and Advanced Drug Delivery Laboratory (bioADD), Dr. Rajadas has developed a center with a wide spectrum of research interests ranging from small molecular design to smart drug delivery programs. Before moving to Stanford, he served as the founding chair of the Bioorganic and Neurochemistry Laboratory at the Council of Scientific and Industrial Research (CSIR) at one of the premier national laboratories in India

He has an M.S. in Chemistry from the University of Madras, and a Ph.D, in Biophysical Chemistry from the Indian Institute of Technology,

“Harnessing Nano for Drug Delivery”

Dr. Kayte Fischer

CTO, Co-Founder, Nano Precision Medical

Nanoscale biomaterial interactions differ significantly from micro and macroscale interactions, enabling a variety of new technologies to address drug delivery challenges. This presentation will focus on nanoscale biological interactions and nano drug delivery technologies (apart from nanoparticles) in the larger drug delivery context. We will direct particular attention to the technology and history of Nano Precision Medical, a small startup in Emeryville that is utilizing titania nanoporous membrane technology to control the rate of drug delivery over the course of months.

Since founding Nano Precision Medical, Dr. Kayte Fischer has been the Chief Technology Officer, coordinating technical development and scientific research with a larger strategic vision for the company.

Kayte completed her Ph.D. in the Therapeutic Micro and Nanotechnology Laboratory at the UC San Francisco/UC Berkeley Joint Graduate Group in Bioengineering, Class of 2010. Her award-winning research focused on novel adhesive properties of nanostructured materials in the context of gastrointestinal drug delivery. During her time in graduate school, Kayte completed the Management of Technology program through the Haas School of Business and the College of Engineering. She also has a designated emphasis in Nanoscale Science and Engineering and served as the president of the Berkeley Nanotechnology Club. Prior to attending graduate school, Kayte graduated with honors from the California Institute of Technology with a B.S. in Mechanical Engineering. She has research experience in a variety of areas, from nanoscale biological interactions to biofluid mechanics and robotics.

"Role of nanoscale materials and devices in transforming our energy system"

Dr. Arun Majumdar

Jay Precourt Professor, Co-Director of the Precourt Instute for Energy.
Department of Mechanical Engineering, Stanford University

This will talk will focus on some game changing technological innovations needed to transform and decarbonize our energy system. In some of them, nanostructured materials and devices can play a very critical role as long as they are integrated into systems where the nanostructures improve performance, reduces cost or both.

Prior to joining Stanford, Dr. Majumdar was the Vice President for Energy at Google, where he created several energy technology initiatives. In October 2009, Dr. Arun Majumdar was nominated by President Obama and confirmed by the Senate to become the Founding Director of the Advanced Research Projects Agency - Energy (ARPA-E), where he served till June 2012. Between March 2011 and June 2012, Dr. Majumdar also served as the Acting Under Secretary of Energy, and a Senior Advisor to the Secretary of Energy.

Prior to joining the Department of Energy, Dr. Majumdar was the Almy and Agnes Maynard Chair Professor of Mechanical Engineering and Materials Science and Engineering at the University of California, Berkeley and the Associate Laboratory Director for Energy and Environment at Lawrence Berkeley National Laboratory. His research career includes the science and engineering of nanoscale materials and devices as well as large engineered systems.

Dr. Majumdar is a member of the National Academy of Engineering, the American Academy of Arts and Sciences and is a Fellow of the Indian National Academy of Engineering. He received his bachelor's degree in Mechanical Engineering at the Indian Institute of Technology, Bombay in 1985 and his Ph.D. from the University of California, Berkeley in 1989. He currently serves on the US Secretary of Energy’s Advisory Board and as a Science Envoy for the US Department of State. He is a member on the Council of the National Academy of Engineering, the Electric Power Research Institute, as well as the Science Board of the Stanford Linear Accelerator Center (SLAC) and the Oak Ridge National Laboratory. He is a member of the International Advisory Panel for Energy of the Singapore Ministry of Trade and Industry and the US delegation for the US-India Track II dialogue on climate change and energy.

“The significance of nanotechnology applications in architecture”

Jan Thoren,

Founder, NanoArchitech

The presentation will be an overview of nanotechnology applications in architecture to create, multi-faceted solutions in resilient building skins, smart building systems and 3D printable buildings. Resilience is the new sustainable structure. Advanced nanomaterials solve critical and complex issues in the global construction industry to prepare for increasing climate change conditions.

A discussion of nanotechnology in smart building systems addresses health, well-being, advanced protection, and sustainability. The same principals of locally sourcing materials can also be applied to extraterrestrial locations near the desired site of construction.

Jan Thoren has been pioneering sustainable architecture and materials since 1986. She was president of Abode Design Associates for over twenty years. She partnered with architectural physicist and inventor John Orava in 2006 in Biophysics Research Foundation and Abode Design . She founded NanoArchitech inc, a bay area technology group in 2013. The startup is developing a series of patents for resilient nanomaterials and a smart building system.

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