MIT Industrial Liaison Program Faculty Knowledgebase Report

2020 MIT ILP Innovation Symposium with Wuxi

January 7, 2020 9:00 am - 5:00 pm

8:00am	Registration
9:00am	Welcome Remarks Graham Rong Program Director, MIT Industrial Liaison Program

Graham Rong
Program Director
MIT Industrial Liaison Program

Dr. Rong is a Program Director of Corporate Relations at MIT. He currently supervises a group of ILP program directors who promote and manage the interactions and relationships between the research at MIT and companies worldwide to help them stay abreast of the latest developments in technology and business practices.

Previously, Dr. Rong founded IKA, LLC. He has led corporate development and product innovation and provided strategic advice to companies in corporate strategy, IT leadership, digital transformation, AI, enterprise content management, and customer relationships. He held senior roles in Harte-Hanks and Vignette Corporation. He held an EU postdoctoral research fellowship at the University of Edinburgh in Scotland where he started global collaborative research.

Dr. Rong is on the board of multiple organizations, including the MIT Sloan Alumni Association of Boston from 2009 to 2012. He chaired MIT Sloan CIO Symposium from 2009-2011. He is a senior expert invited by international organizations.

Dr. Rong holds an M.B.A. in global and innovation leadership from the MIT Sloan School of Management and a Ph.D in numerical computing from the University of Guelph in Canada.

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Haidong Sun

9:30am

Advanced Materials and Systems at the Energy and Water Nexus

Gang Chen
Carl Richard Soderberg Professor of Power Engineering, MIT Department of Mechanical Engineering

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Carl Richard Soderberg Professor of Power Engineering
MIT Department of Mechanical Engineering

Gang Chen is the Carl Richard Soderberg Professor of Power Engineering at the Massachusetts Institute of Technology (MIT). He served as the Department Head of the Department of Mechanical Engineering at MIT from 2013 to 2018. He obtained his PhD degree from the Mechanical Engineering Department at UC Berkeley. He was a faculty member at Duke University and UCLA before joining MIT in 2001. He received an NSF Young Investigator Award, an R&D 100 award, an ASME Heat Transfer Memorial Award, an ASME Frank Kreith Award in Energy, a Nukiyama Memorial Award by the Japan Heat Transfer Society, a World Technology Network Award in Energy, an Eringen medal from the Society of Engineering Science, and the Capers and Marion McDonald Award for Excellence in Mentoring and Advising from MIT. He is a fellow of the American Association for the Advancement of Science, the American Physical Society, The American Society of Mechanical Engineers, and the Guggenheim Foundation. He serves on the board of the Asian American Scholar Forum (aasforum.org). He is an academician of Academy Sinica, a fellow of the American Academy of Arts and Sciences, a member of the US National Academy of Engineering, and a member of the US National Academy of Sciences.

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This talk will present some of our recent work on advanced materials, including high thermal conductivity plastics and optically opaque and infrared transparent fabrics, and clean water technologies. Although polymers are usually thermal insulators, we show that they can be made as thermally conductive as metals by aligning molecular orientations. With properly chosen polymer fiber diameters, we design fabrics so that they are opaque to visible light and yet allow thermal radiation from human body to escape to environment for passively cooling of human body. We also demonstrate the ability of boiling water and even creating super-heated steam under unconcentrated sunlight using spectrally selective surfaces and thermal insulations.

10:10am

Developments in Hydrogen Generation, CO2 Reuse and CCS for Clean Energy
Ahmed Ghoniem

Ronald C Crane (1972) Professor of Mechanical Engineering
Director, Reacting Gas Dynamics Laboratory (RGD)
Director, Center for 21st Century Energy
MIT Department of Mechanical Engineering

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Ahmed Ghoniem the Ronald C. Crane Professor of Mechanical Engineering, Director of the Center for Energy and Propulsion Research and the Reacting Gas Dynamics Laboratory at MIT. He received his B.Sc. and M.Sc. degree from Cairo University, and Ph.D. at the University of California, Berkeley. His research covers computational engineering with application to turbulence and combustion, multiphase flow and multiscale phenomena, clean energy technologies with focus on CO2 capture, renewable energy and alternative fuels. His research has made fundamental contributions to multiscale simulations, thermochemistry, combustion dynamics, energy systems and materials chemistry. He supervised more than 100 M.Sc., Ph.D. and post-doctoral students, many are leaders in academia, industry and governments; published more than 500 refereed articles in leading journals and conferences; lectured extensively around the World; and consulted for the aerospace, automotive and energy industry. He is fellow of the American Society of Mechanical Engineer (ASME), the American institute of Physics (APS), the Combustion Institute (CI), and associate fellow of the American Institute of Aeronautics and Astronautics (AIAA). He received several prestigious awards including the ASME James Harry Potter Award in Thermodynamics, the AIAA Propellant and Combustion Award, the KAUST Investigator Award and the Committed to ?Committed to Caring Professor? at MIT. He is currently the MIT PI of the Center of Excellence for Energy, a $30M effort to improve energy research, education and entrepreneurship in Egypt.

We will summarize our recent work on the development of materials, reactors and systems for clean energy including carbon capture, water splitting and CO_2 reuse. Oxy-combustion is an efficient carbon capture technology that requires high efficiency air separation, we will show how using metal oxides/pervoskites in the form of ion-transport membrane enables the integration of air separation and fuel oxidation. Integrated with gasification, it can be applied to coal. Similar materials can be used but with different elements and catalysts for water splitting using intermediate temperature heat, CO_2 reduction as well as the conversion of natural gas to chemicals feedstock.

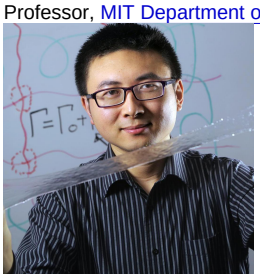
10:50am

Networking Break

11:20am

Merging Human-Machine Intelligence with Soft Materials Technology

Xuanhe Zhao
Professor, MIT Department of Mechanical Engineering



Xuanhe Zhao
Professor
MIT Department of Mechanical Engineering

Xuanhe Zhao is a Professor of Mechanical Engineering at MIT. The mission of Zhao Lab is to advance science and technology between humans and machines to address grand societal challenges in health and sustainability. A major current focus is the study and development of soft materials and systems. Dr. Zhao has won early career awards from NSF, ONR, ASME, SES, AVS, Adhesion Society, JAM, EML, and Materials Today. He has been a Clarivate Highly Cited Researcher since 2018. Bioadhesive ultrasound, based on Zhao Lab's work published in Science, was named one of TIME Magazine's Best Inventions of the year in 2022. SanaHeal Inc., based on Zhao Lab's work published in Nature, was awarded the 2023 Nature Spinoff Prize. Over ten patents from Zhao Lab have been licensed by companies and have contributed to FDA-approved and widely-used medical devices.

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Whereas human tissues and organs are mostly soft, wet and bioactive; machines are commonly hard, dry and biologically inert. Merging humans, machines and their intelligence is of imminent importance in addressing grand societal challenges in health, sustainability, security, education and joy of living. However, interfacing humans and machines is extremely challenging due to their fundamentally contradictory properties. At MIT Zhao Lab, we exploit *soft materials technology* to form long-term, high-efficacy, multi-modal interfaces and convergence between humans and machines. In this talk, I will first discuss the mechanics to design extreme properties including tough, resilient, adhesive, strong, fatigue-resistant and conductive for hydrogels, which are ideal material candidates for human-machine interfaces. Then I will discuss a set of soft materials technology platforms, including i). bioadhesives for instant strong adhesion of diverse wet dynamic tissues and machines; ii). bioelectronics for long-term multi-modal neural interfaces; iii). biorobots for teleoperated and autonomous navigations and operations in previously inaccessible lesions such as in cerebral and coronary arteries. I will conclude the talk with a perspective on future human-machine convergence enabled by soft materials technology.

12:00pm MIT Startup Exchange Lightning Talks

- **CATALOG**: *DNA for data storage & computation*
- **TetraScience**: *Streamlined R&D lab workflows with data integration*
- **2D Materials**: *High performance graphene for industrial materials performance*
- **GTL Biofuel Inc.**: *Sustainable liquid fuels & protein from alternative sources*
- **Manus Robotics**: *Wearable robotic grippers to enable*

Nick Gold
VP of Marketing, CATALOG

Nick Gold
VP of Marketing
CATALOG

Nick Gold spent 15 years with systems integrator and consultancy Chesapeake Systems, where he held roles as Chief Revenue Officer and Lead Technologist. During this time he developed an expertise in data storage, workflow automation, and information management (MAM) systems. He was actively involved with designing technology solutions for customers in media and entertainment, government, corporations, political campaigns, NGOs, and non-profits.

Gold is an active member of the Association of Moving Image Archivists, and serves as the conference chair for AMIA's annual New York City-based Digital Asset Symposium. He is a published author on service-oriented architecture and contemporary microservices-based approaches to system design in the Henry Stewart Journal of Digital Media Management, and serves as a member of the publication's editorial board.

In April of 2019, Gold joined the team at Boston-based startup CATALOG, which is commercially developing DNA-based data storage and biocomputing technologies.

Kai Wang
Delivery Lead
TetraScience, TetraScience

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Delivery Lead
TetraScience
TetraScience

Kai Wang leads the Delivery Team for, and is a founding member of, TetraScience, a Boston, MA-based cloud technology company that provides a Data Integration Platform for Life Sciences R&D Labs. Prior to leading the Delivery Team, Wang served as a senior software engineer at TetraScience. He designed and implemented critical components of the TetraScience cloud solution, including multiple generations of IoT infrastructure and firmware. He also led an IoT collaboration with AnyLink (a WuXi-based company). As the Delivery Team Lead, Wang applies his knowledge about cloud infrastructure to architect and deliver TetraScience's solutions to the world's top biotech and pharmaceutical companies. He holds a BS and MEng in electrical and computer engineering from Cornell University.

Patrick Teyssonneyre
CEO, 2D Materials

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CEO
2D Materials

Patrick Teyssonneyre is a global senior executive, entrepreneur, and angel investor with more than 19 years of experience in leading the development of numerous technologies, products, and applications to successful commercialization in the chemical and advanced materials industries. Currently, he is the CEO of 2D Materials Pte Ltd (2DM), a company based in Singapore that manufactures high performance graphene as an industrial additive to enhance the properties of many industrial materials, such as paints, coatings, batteries, composites, polymers, and lubricants. Teyssonneyre holds an MBA from the Massachusetts Institute of Technology.

Bob Meng
Founder & CEO
GTL Biofuel

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Founder & CEO
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Bob Meng is the founder and CEO of GTL Biofuel. Previously, Meng cofounded and served as CEO of Shanghai GTL Biotech. He holds a Masters from Peking University.

Sheng Liu

12:50pm	Lunch with Startup Exhibit

2:40pm Industry Panel: Advanced Manufacturing

Moderator: David Zhu
Panels: Wilson Chu, Tianwen Liu, Yong Zhao

David Zhu
Program Director, MIT Corporate Relations

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Program Director, MIT Corporate Relations

David Zhu has extensive experience in the technology and energy industries ranging from research and development, operations management, M&As and investments.

As a Program Director, Zhu manages the interactions and collaborations between MIT and companies worldwide to address challenges in technological innovations and business practices.

Previously, Zhu was a Managing Director at Maxis Capital. At Maxis, he worked with a number of Chinese and US companies and managed private equity investment opportunities in the technology, telecom, semiconductor and clean energy industries.

Before he was at Maxis Capital, Zhu was an Technology banker at Key Bank where he focused on mergers and acquisitions transactions in the software and financial technology areas. He has also held positions at Virtual Back Office Software Inc. and Kana Inc. in the Boston area where he managed software development and client engagements, and provided solutions to global companies.

Wilson Chu
Chairman, Defond Group

Wilson Chu
Chairman
Defond Group

Wilson graduated from UC Berkeley engineering school in 1979 and joined Defond. Within 2 years Defond was the first switch maker in Hong Kong to obtain UL approval and quickly became the top supplier for that market. Today, Defond is the biggest global supplier of switches for the power tools sector. During the early ‘90s Defond started involvement in electronics and was the top supplier of Appliance Leakage Circuit Interrupters for the US market. With a combination of expertise on mechanical, electronics and firmware, Defond

Tianwen Liu
Chairman & CEO, iSoftStone

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iSoftStone

Mr. Tianwen Liu (TW Liu) is the founder, Chairman and CEO of iSoftStone Holdings Ltd. (NYSE: ISS), a leading China-based provider of consulting & solutions, IT services and business process outsourcing to clients both domestically in China and worldwide.

Mr. Liu has over 20 years experience in technical and management roles in the IT industry. Since founding iSoftStone in 2001, Mr. Liu has become a leading voice for China's IT outsourcing industry and the globalization of Chinese enterprises, and has been recognized by domestic and international publications as such. Mr. Liu received the “Award of People of the Year with Remarkable Contributions to Outsourcing in China” for three consecutive years (2010 - 2012) by Ministry of Commerce of the People’s Republic of China, as well as awarded “Top Leaders of the Past 10 Years in China IT Services Industry” in 2012.

Prior to iSoftStone, Mr. Liu co-founded AsiaEC.com in 1999 and led efforts to build the company from inception to become China's largest on-line office supply and services provider (until it was acquired by Office Depot in 2006). He also served in multinational companies such as Bechtel and Siemens.

Mr. Liu is a Sloan Fellow and holds an MBA degree from the Massachusetts Institute of

3:20pm Networking Break

3:40pm Microfluidic Engineering for Biomanufacturing and Cell Therapy

Microfluidic devices offer unique capabilities to control and manipulate biomolecules and cells, which can be utilized to enhance the efficiency of conventional biomanufacturing processes, as well as to advance novel therapeutic modalities such as cell therapy. In this presentation, I will showcase several examples where high-volume processing microfluidic systems are used for increasing efficiencies for perfusion bioreactor, monitoring product quality in real time at line, and detect low-abundance adventitious agents for enhancing overall safety.

Jongyoon Han

Professor of Electrical Engineering, Department of Electrical Engineering & Computer Science (EECS)
Professor of Biological Engineering, Biological Engineering Division

Jongyoon Han

Professor of Electrical Engineering, Department of Electrical Engineering & Computer Science (EECS)
Professor of Biological Engineering, Biological Engineering Division

Dr. Jongyoon Han is currently a professor in the Department of Electrical Engineering and Computer Science and the Department of Biological Engineering, Massachusetts Institute of Technology. He received B.S.(1992) and M.S.(1994) degree in physics from Seoul National University, Seoul, Korea, and Ph.D. degree in applied physics from Cornell University in 2001. He was a research scientist in Sandia National Laboratories (Livermore, CA), until he joined the MIT faculty in 2002. He received NSF CAREER award (2003) and Analytical Chemistry Young Innovator Award (ACS, 2009). His research is mainly focused on applying micro/nanofabrication techniques to a very diverse set of fields and industries, including biosensing, desalination / water purification, biomanufacturing, dentistry, and neuroscience. He is currently the lead PI for MIT's participation for NIIMBL (The National Institute for Innovation in Manufacturing Biopharmaceuticals).

4:20pm

Printing Optical Materials
Nicholas Fang

Professor of Mechanical Engineering
MIT Department of Mechanical Engineering

Nicholas Fang

Professor of Mechanical Engineering
MIT Department of Mechanical Engineering

Nicholas X. Fang received his BS and MS in physics from Nanjing University, and his PhD in mechanical engineering from University of California Los Angeles. He is currently professor of Mechanical Engineering at MIT. Prior to MIT, he worked as an assistant professor at the University of Illinois Urbana-Champaign from 2004 to 2010. Professor Fang's areas of research look at nanophotonics and nanofabrication. His recognitions include the ASME Chao and Trigger Young Manufacturing Engineer Award (2013); the ICO prize from the International Commission of Optics (2011); an invited participant of the Frontiers of Engineering Conference by National Academies in 2010; the NSF CAREER Award (2009) and MIT *Technology Review Magazine's* 35 Young Innovators Award (2008).

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Will future of smart lighting and window coatings enable energy-efficient cooling in smart buildings? Can printed color converters lead to next generation micro displays with high brightness, sharp image resolution, and ultra low-power consumption? Recently, exciting new physics of nanoscale optical materials has inspired a series of key explorations to manipulate, store and control the flow of information and energy at unprecedented dimensions. In this talk I will report our recent efforts on controlling light harvesting and conversion process using scalable micro/nanofabrication. These emerging optical materials show promise to a range of important applications, from optical networks and chip-scale photonic sensors to lasers, LEDs, and solar technology.

For example, pixelated color converters are envisioned to achieve full-color high-resolution display through down conversion of blue micro-LEDs. Quantum dots (QDs) are promising narrow-band converters of high quantum efficiency and brightness enabling saturated colors. However, challenges still remain to produce high resolution color-selective patterns compatible with the advanced blue micro-LEDs with pitch and pixel size approaching 1 μm. Here we demonstrate our preliminary study on scalable printing of high-resolution pixelated red and green color converters patterned through projection lithography. I will also discuss potential applications such as high-resolution wide-gamut microdisplay for mixed reality and high speed visible light communication.

In this talk, I will also introduce versatile 3D shape transformations of nanoscale structures by deliberate engineering of the topography-guided stress of gold nanostructures. By using the topography-guided stress equilibrium, rich 3D shape transformation such as buckling, rotation, and twisting of nanostructures is precisely achieved, which can be predicted by our mechanical modeling. Benefiting from the nanoscale 3D twisting features, giant optical chirality is achieved in an intuitively designed 3D pinwheel-like structure, in strong contrast to the achiral 2D precursor without nano-kirigami. The demonstrated nano-kirigami, as well as the exotic 3D nanostructures, could be adopted in broad nanofabrication platforms and could open up new possibilities for the exploration of functional micro-/nanophotonic and mechanical devices.

5:00pm

Adjournment