

UNIVERSITY OF CALIFORNIA, IRVINE

DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING

SPECIAL SEMINAR

DISRUPTIVE INNOVATION AND THE ENERGY TRANSITION: ROAD TO NET ZERO



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Monday, June 10, 2024

2:00 - 3:15 PM

Engineering Tower, Conference Room 652

Abstract: Through the various industrial revolutions, economic development has historically coincided with increasing demand for materials, resulting in growing energy consumption and related harmful emissions. The increase in electrification in all sectors of energy use and significantly higher penetration of intermittent energy sources, such as solar and wind, will require abundant storage solutions as well as critical minerals for electricity. Sustainable mining of materials such as lithium, cobalt, copper, nickel, and rare earth elements will play an essential role in the energy transition. This need leads us to “creative sustainable disruption,” when innovation is both eliminating detrimental methods and creating new avenues of doing work, with industries rising and falling in response. Take, for example, the confluence of two game-changing innovations: petroleum refinement for use as a fuel source and the discovery of materials and related engineering to design engine blocks for the modern automotive industry. Both made whale oil, stagecoaches and pony traps obsolete. Clean energy transitions must decouple these trends and offer a balance whilst developing efficiency strategies to reduce harmful emissions throughout value chains, with a reduced carbon footprint, while allowing opportunities to harness sustainable low-carbon energies, our path to netzero. Academia and our erudite faculty to lead this step change innovation process. Industry to focus on adoption of such inventions and directed research leading to new product developments for commercial enterprises. My talk will highlight innovations, know-hows conceived, embodiments developed while working in fossil-based energy, their adaptability and crosspollination during transitioning to low/zero carbon sources. In this talk, given our current interests, I will focus on Wind and Geothermal as sustainable and low carbon energy sources and highlight some of our work on H2. Wind: Smart Nano Composites to Enable Remote Inspection of Offshore Wind Energy Systems: A Mission to Reduce Human Exposure to Hazards Geothermal: Tapping into the heat below, harnessing super-hot rocks (SHR), the always available, sustainable energy. I will present technology developments in the focus areas where we plan to explore, expand and innovate (a) corrosion resistant, high strength tubulars for enhanced geothermal: extrusion and thermo-mechanical processing of a nickel superalloy for enhanced mechanical properties, and (b) engineered for enhanced geothermal systems, an unflashed perforating gun, designed with a multi-layered CRA nano-composite tubing with near-zero thermal conductivity.

Bio: Former “UC Regents Fellow”, Dr. Indranil Roy pursued his Ph.D. at the University of California, Irvine on mechanical properties and origin of corrosion resistance of bulk nanocrystalline materials on National Science Foundation, NIRT program, graduated fall 2006. He subsequently pursued an Executive MBA at the Jones Business School, Rice University, graduated Spring, 2019. In Fall 2006, Dr. Roy joined Schlumberger Technology Corporation. He has worked in field operations and several different technology groups from “Downhole Testing” to “Enabling Technologies”. In his last role at Schlumberger, he was the Technology Manager for Nano Materials in Schlumberger’s, “Infinity” product line (\$4 billion market). His primary goal was developing innovative solutions and novel materials to harness high pressure and temperature sour environments and unconventional reservoirs. Among many accolades, Dr. Roy is the recipient of 2010 SLB Reservoir Testing award for his, “Dense Gas” discovery; SLB’s “Innovation Project” awards for 2011, 2012 – RTST and 2013, 2015 - Completions. In 2016, during his affiliation to the Varanasi Lab at the department of Mechanical Engineering, MIT as a visiting researcher, Dr. Roy was invited by Prof. Varanasi at MIT to spearhead UniPolar Technologies, his start-up on emulsion separation as their CEO. UniPolar closed a seed round of \$2 M from Diane Green, former Senior Vice President, Google and BOD, Alphabet; Ratan Tata, Chairman emeritus, Tata and Sons. In Q4 2019, under the patronage of Dr. Kamel BenNaceur, former Director for Sustainability, Technology and Outlooks at the IEA, former Minister of Energy, Industry and Mines of Tunisia, 2022 SPE President and current member of the National Petroleum Council for 2024-2025 as its Chairman, Dr. Roy pivoted and co-founded DAMORPHE. Their young technology company bridges technology gaps in materials and sensing domains spanning sustainable Agri-Tech, Energy, Geothermal, Biomedical, among others, through effective use of smart amorphous alloys & nanomaterials with artificial intelligence across domains. Dr. Roy manages its research and innovation portfolio as their Chief Technology Officer (CTO). DAMORPHE prides in Corporate Social Responsibility (CSR), ESG and an unwavering commitment to contributing, as an organization, to a flourishing human-ecological system, to protect, care for and responsibly use the environment in pursuit of social outcomes in diverse social-ecological contexts. DAMORPHE is currently expanding into Geothermal, planning to harness the Super-hot rocks at Salton Sea for a sustainable energy source and investigating Direct Lithium Extraction (DLE) of Lithium from its corrosive hydrothermal brines. Prof. James Earthman, UCI, Dr. Roy’s former doctoral advisor serves as a Director of their “Green Energies Portfolio”. They are working on a new course offering for Fall 2024 at UCI on materials for sustainable energy, with Dr. BenNaceur, Dr. Roy and others delivering lectures. Dr. Roy has published several articles, proceedings and delivered numerous invited talks and seminars both nationally and internationally (France, Japan, Vienna, Turkey, Brazil etc.). He has over 60 US and international patents/patent applications on some of his key inventions and findings: Ultra high strength water reactive alloys, nature of dense wet gases, HPHT phase behavior of supercritical reservoir fluids (Dense Gas discovery) etc. Since 2014, Dr. Roy serves as the Chairman of Minerals, Metals and Materials society (TMS) subcommittee for oil and gas industry’s flagship convention, Offshore Technology conference’s (OTC) program committee. He has served as one of ten (10) industry advisors to the TMS. Dr. Roy was SLB’s representative and a member of the UCSD’s, “Corporate Affiliate (CAP) Program”. He has spearheaded several international symposiums, notably “AMREE” at TMS Annual Meetings.