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**"Improving the Sustainability of
Solvent-Borne Paints and Coatings
through Fundamental Studies of
Polymerization Reactions"**

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3:30 PM

Wu and Chen Auditorium
Levine Hall

ABSTRACT

The global market size of paints and coatings (P&C) was US\$164 Billion in 2022 and is forecast to grow to US\$241 Billion by 2030. A fast-growing sector in the P&C industries is acrylics. P&C should contain a solvent in order to be brushable/sprayable. However, in the case of solvent-borne P&C, their improved sustainability requires decreasing their organic solvent contents. This sustainability-applicability tradeoff can be addressed by preparing P&C from polymers with lower average molecular weights, which can be produced via high-temperature ($> 130\text{ }^{\circ}\text{C}$) free-radical polymerization. However, at these temperatures, several reactions – that are of little significance at low temperatures – strongly affect the polymer product quality. These so-called secondary reactions include monomer self-initiation, monomer-solvent and monomer-molecular oxygen co-initiation, depropagation, β -scission, and backbiting. We have made advances in quantum-level polymerization reaction modeling – that have enabled us to discover new reactions and fundamentally study previously known reactions in thermal polymerization of acrylates – as well as in macroscopic-scale mechanistic modeling and optimization of high-temperature polymerization reactors. Sample results from these studies will be presented. They will include new theoretical and experimental insights that can be used to produce more sustainable, higher-quality acrylic P&C at lower costs. The self-initiation of acrylates at high temperatures improves the polymer quality and reduces the operating costs due to less or no use of relatively expensive conventional initiators.

BIO

Masoud Soroush is a professor of Chemical and Biological Engineering at Drexel University and the director of the National Science Foundation-sponsored Smart Manufacturing Research Experiences for Undergraduates (SMREU) Site. He was a Visiting Scientist at DuPont Marshall Lab, Philadelphia, 2002–2003, and a Visiting Professor at Princeton University in 2008. He received his BS in chemical engineering from Abadan Institute of Technology, Iran, and his MS and PhD in chemical engineering from the University of Michigan, Ann Arbor, where he also earned an MS in electrical engineering. His research incorporates advanced manufacturing of novel materials for health, sustainability, and energy; polymers; polymer membranes; functional safety; and process systems engineering. He is an elected fellow of the AIChE and a senior member of the IEEE. His awards include the AIChE 2023 Excellence in Process Development Research Award, the AIChE 2021 Institute Award for Excellence in Industrial Gases Technology, National Science Foundation Faculty Early CAREER Award, and the American Automatic Control Council 1999 O. Hugo Schuck Best Paper Award.