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### **Empowering Green Chemistry and Engineering with Tunable Liquid Phases**

#### **ABSTRACT:**

Gases such as carbon dioxide and light hydrocarbons ( $C_2$ - $C_4$ ) possess critical temperatures that are relatively close to ambient temperatures. Consequently, their densities and transport properties can be pressure-tuned from gas-like at ambient conditions to liquid-like at mild pressures. In their liquid states, they exhibit unusual pressure-dependent solubility characteristics of gases such as ozone, oxygen, hydrogen and carbon monoxide. We have harnessed these properties for facile and highly selective conversion of such gases, many of them relevant as emerging chemical feedstocks, to desired products. Examples that will be highlighted in the seminar include (a) selective liquid phase ethylene epoxidation with methyltrioxorhenium catalyst and hydrogen peroxide as oxidant, (b) propylene hydroformylation with Rh complexes, (c) intensified electrocatalytic  $CO_2$  reduction, and (d) liquid phase ozonation of isobutane to tertiary butyl alcohol. The role of quantitative sustainability analyses in the development of these technologies will also be discussed.

#### **BIO:**

Bala Subramaniam is the Dan F. Servey Distinguished Professor of Chemical & Petroleum Engineering at the University of Kansas (KU). He earned a B.Tech. in Chemical Engineering from the University of Madras, India and his Ph. D. in Chemical Engineering from the University of Notre Dame. Subramaniam has held visiting professorships at the University of Nottingham, United Kingdom and the Institute of Process Engineering, ETH, Zürich, Switzerland. Subramaniam's research interests are in catalysis and reaction engineering. His research has exploited the pressure-tunable properties of unconventional solvents such as supercritical fluids and gas-expanded liquids to develop resource-efficient catalytic technologies. Subramaniam has 220+ publications, 32 issued patents, 1 textbook and 2 edited books. He is the founding Director of the Center for Environmentally Beneficial Catalysis (CEBC), initiated as an NSF Engineering Research Center. Prior to becoming CEBC Director, Subramaniam served as chair of his department. Subramaniam is executive editor of *ACS Sustainable Chemistry and Engineering* journal and chaired the 2018 Gordon Research Conference in Green Chemistry. He served as the President of the International Symposia in Chemical Reaction Engineering (ISCRE, Inc.) and served on the Dow Chemical Company's Technical Advisory Board. His honors include ASEE's Dow Outstanding Young Faculty Award, Indian Institute of Chemical Engineers' Chemcon Lectureship Award, and KU's Higuchi Research Achievement Award. Subramaniam is a Fellow of the AIChE, the ACS Industrial & Engineering Chemistry Division, and the National Academy of Inventors.