

CHEMICAL AND BIOLOGICAL ENGINEERING DEPARTMENT SEMINAR SERIES

***High Selectivity Methane Coupling at High Pressure  
Using Novel, Defect/Disordered Rare Earth  
Oxycarbonate Based Catalyst Systems***

Presented by: M. M. Bhasin, The Dow Chemical Company

Time: Wednesday, September 2; 3:15 – 4:30 pm

Location: Perlstein Hall Auditorium

**Abstract**

Methane is an attractive raw material for producing ethylene and propylene because it is widely available and inexpensive compared to the natural gas liquids (ethane, propane, butane and higher hydrocarbons). However, supply of natural gas liquids have not kept pace with the demand for ethylene and propylene, hence more costly cracking processes that use naphtha from petroleum are being commercialized. Therefore, development of economical processes for manufacturing olefins and other hydrocarbons from methane is highly desirable. A very important challenge in coupling methane at higher pressures of 10-20 atmospheres is the precipitous loss in selectivity over all prior art catalyst compositions. This presentation will cover several series of non-stoichiometric, rare earth oxycarbonates based catalyst systems that have been discovered that provide, for the first time, 65-70% selectivity to C<sub>2</sub>+ hydrocarbons at 125+ psig pressure and at temperatures as low as 450-600°C in microreactors that are stable for ~30 days. These novel catalyst systems are characterized as having non-stoichiometric, defect/disordered surface structure – as determined by various atomic level resolution techniques.

**Biography**

M. M. Bhasin is a Senior Scientist at Union Carbide Corporation, a subsidiary of The Dow Chemical Company, and a member of the National Academy of Engineers. He received his Ph.D. in physical chemistry from University of Notre Dame in 1963. Dr. Bhasin has received numerous awards throughout his career, including the Herbert H. Dow Gold Medal, the Dow President's Award, the Dr. Martin Luther King, Jr., Recognition Award, the Industrial Research Institute Technology Achievement Award, the American Institute of Chemical Engineering Award for Chemical Engineering Practices and the American Chemical Society Award in Industrial Chemistry. Bhasin has 21 publications in journals, 22 U.S. patents and various foreign patents, as well as co-edited the book *Methane and Alkane Conversion Chemistry*. He has also served as the invited speaker at national/international meetings of Catalysis Society, Catalysis Clubs, ACS, AIChE and universities industries and government institutes worldwide, including plenary and keynote addresses at meetings.

Bhasin's research interests are concentrated in the following areas: (i) catalysts and process for the epoxidation of ethylene to ethylene oxide; (ii) oxidative dehydrogenation of methane to produce ethylene and ethane; (iii) catalytic, selective hydrogenation and dehydrogenation processes and catalysts; (iv) hydrodesulfurization, hydrodealkylation and hydrocracking of hydrocarbons; (v) direct conversion of synthesis gas (CO<sub>2</sub>+H<sub>2</sub>) into acetaldehyde, acetic acid and ethanol; (vi) various spectroscopic techniques, such as Auger, XPS, ISS, Scanning Auger Microprobe Surface, spectroscopic studies of various catalysts to establish the cause(s) of catalyst deactivation and understand catalysis fundamentals, and Infrared and Raman spectroscopic studies of chemisorbed species; (vii) novel Autoexhaust emission control catalysts on Alpha-alumina.