Catalysis Today 142 (2009) 1

Contents lists available at ScienceDirect

Catalysis Today

journal homepage: www.elsevier.com/locate/cattod

Preface

The present volume contains a selection of papers presented in session 10, Natural gas conversion, at the Europacat VIII conference held in Turku (Åbo), Finland, on August 26–31, 2007. The guest editors selected a number of papers for invitation, and received manuscripts have undergone a peer review process. Contributions span from direct conversion including oxidative coupling and bromination, Fischer–Tropsch synthesis, methanol to olefins, partial oxidation and steam reforming as well as dehydrogenation. Characteristic is that new processes are developed that requires more effective catalysts at non-conventional conditions.

Direct conversion of methane encompasses techniques like methane cracking to hydrogen and carbon monoxide, oxidative coupling to ethane and ethylene, partial oxidation to methanol or formaldehyde, dehydroaromatization, alkylation, ammoxidation, low-temperature C–H activation, pyrolysis to acetylene, halogenation and oxyhalogenation as well as enzymatic reactions. There has been a strong scientific effort in this area, particularly due to the interest in oxidative coupling from early 1980s. However, challenges with protecting the reactive olefin from further oxidation, leading to low yields, have caused a reduced interest. In later years, a broader perspective on direct conversion of methane has emerged. Still, apart from more specialized production of carbon black, HCN and acetylene, there appears that a major breakthrough is needed before large-scale industrial production will be feasible.

Indirect conversion of methane through synthesis gas certainly is the mainstream industrial pathway for converting methane (and natural gas) to hydrogen, petrochemicals or fuel. Due to the high cost of the syngas step and the environmentally driven interest in producing hydrogen with carbon capture, new processes, catalysts and reactors are being investigated. Progress are made in areas like compact reforming, gas heated reforming, oxygen ion transport membranes, hydrogen and proton membranes, sorption enhanced processes, chemical looping, etc. Associated are efforts in developing new materials, e.g. high temperature corrosion resistant construction materials, membranes with suitable stability and fluxes, sorbants with sufficient capacity and adsorption/desorption kinetics and catalysts that can operate under the desired process conditions in new environments.

Conversion of natural gas-based syngas to fuels through the Fischer–Tropsch reaction is being industrialized at a large scale and with improved technology. Fundamentals of the catalytic reaction governing activity, selectivity and stability are being debated. Issues include the (possible) structure sensitivity of the cobalt catalyst, electronic and promoter effects and deactivation mechanisms. Another major area in gas conversion is production of olefins. Alternatives to conventional steam cracking are dehydrogenation of light paraffins and the emerging methanol-to-olefin technology. In the latter area, the carbon pool mechanism seems to have gained confidence. Concerning dehydrogenation, improvements can be found in an autothermal system that minimizes overall energy consumption.

Guest Editors
Erling Rytter[a,*]
Leon Lefferts[b]
Riitta Keiski[c]
[a]*StatoilHydro Research Centre Trondheim, Norway*
[b]*University of Twente, The Netherlands*
[c]*University of Oulu, Finland*

*Corresponding author
E-mail address: ERR@StatoilHydro.com (E. Rytter)

Available online 23 February 2009

doi:10.1016/j.cattod.2009.01.003