

Structured catalysts for gas-to-liquids processes

Hongyun Yang

Structured catalysts that consist of thermally conductive structures and immobilized micron- or nano-sized catalysts thereon have demonstrated a unique ability to improve reaction rate and heat transfer rate simultaneously. Therefore, they have been applied to the intensification of various GTL processes, e.g. Fischer Tropsch Synthesis (FTS) and methanol synthesis. In the T&E for FTS, the measured thermal conductivities of a structured catalyst bed were much larger than those of a conventional packed bed. The maximum radial temperature gradient inside a 2" structured catalyst bed was negligible while a packed bed with the same catalyst loading experienced a thermal runaway even at a low reactor wall temperature. Due to the efficient heat transfer, structured catalysts can provide (1) improved FTS process safety and stability, (2) extended catalyst life, (3) highest possible selectivity to desired products, and (4) reduced CAPEX. As a result, they have the great potential to drop the CAPEX and OPEX of FTS as well as other GTL processes and to enable the economic utilization of abundant natural gas resources in the United States. Besides GTL, this approach can also be applied to other extremely exothermic and endothermic processes such as ethylene oxidation, ammonia synthesis, steam methane reforming, etc.