

Hydrocarbon Reforming Catalysts and New Reactor Designs for Compact Hydrogen Generators

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Abstract

A hydrogen based future energy scenario will use fuel cells for the conversion of chemically stored energy into electricity. Depending upon the type of fuel cell, different specifications will apply for the feedstock which is converted in the cell, ranging from very clean hydrogen for PEM-FC's to desulfurized methane for SOFC and MCFC technology. For the foreseeable future, hydrogen will be supplied by conventional reforming chemistry, however operated in compact and dynamic reformer designs. This requires that known catalyst formulations are offered in specific geometries, giving flexibility for novel reactor design options. These specific geometries may be special pellet shapes as well as monolith structures. Finally, also non-hydrocarbon feedstock might be used in special applications, e.g. methanol or bio-based ethanol.

BASF offers catalysts for the full process chain starting with feedstock desulfurization via reforming, high temperature shift, low temperature shift to CO fine polishing either via selective oxidation or selective methanation.

Depending upon the customer design, most stages can be served either with precious metal based monolith solutions or base metal pellet catalysts. For the former, we have taken the automobile catalyst monolith support and extended its application to the fuel cell hydrogen generation. Washcoats of precious metal supported catalysts can for example be deposited on ceramic and metal heat exchangers for efficient generation of hydrogen, the major advantages being high through puts due to more efficient heat transfer, lower pressure drop with greater catalyst mechanical and thermal stability compared to particulate catalysts.

Base metal pellet catalysts on the other hand can have intrinsic cost advantages, larger fractions of the reactor can be filled with active mass, and if produced in unconventional shape, again novel reactor designs are made possible.

Finally, for the reforming of oxygen containing feedstocks like methanol or (bio-)ethanol, new catalyst formulations are needed which have been successfully developed and field tested.

