

460a Novel Catalyst Development for Steam Reforming of Natural Gas

Pradeepkumar O. Sharma, Martin A. Abraham, and William A. Whittenberger

Production of hydrogen from natural gas is the most cost effective and simplest technology for commercial generation. It is also a likely source of hydrogen in home fuel cell systems, since natural gas is widely available. Although catalyst technology is available for natural gas conversion, the design of new catalysts and new catalytic supports provides an opportunity to make the conversion of natural gas to hydrogen more cost effective. Catalysts based on rhodium and nickel, and supported on ceria or zirconia, provide the basis for the development of more selective, stable, and active catalysts.

The analysis of catalyst performance (activity and stability) is evaluated over a range of reaction conditions. Catalyst samples are supported on a base metal oxide coated metal monolith, and evaluated in a flow reactor for up to 100 hours. A series of experiments has been completed at atmospheric pressure to evaluate the optimum loading of rhodium and nickel for this system. Rhodium is an essential component for the effective conversion of natural gas to hydrogen. The experimental results show an increase in the conversion of methane from 60% to 98% with the addition of rhodium. Catalysts with higher rhodium also show greater stability. Surface analysis of catalysts before reaction and following 100 hr experiments provide insight into the mechanism of deactivation, and the basis for improved catalyst stability. Experiments at elevated pressure are completed to determine the changes in catalyst performance (activity and stability) when the process is completed under commercially relevant conditions.