A new reactor for methanol autothermal reformer

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Autothermal methanol steam reforming provides a most convenient means of producing hydrogen, in particular for mobile applications, in small scale. The fuel processor based on the autothermal reforming is characterized by fast start-up, rapid load-following, and above all most compact design. The autothermal reaction in fact consists of two part: in the first part, where oxygen is present, an exothermic reaction, methanol partial oxidation or methanol combustion, occurs, whereas in the second part, an endothermic reaction, methanol steam reforming, takes place. In a conventional reformer such as Johnson-Matthey Hot-spot reformer, the heat generated in the first part gives rise to a hot-spot, the temperature of which can exceeds 400℃. Hence severe sintering and deactivation of the catalyst, typically Cu-based catalyst, have been technical problems to be overcome in the development of the reformer. In this study, we developed a new reactor design with enhanced heat transfer charateristics so that the hot-spot was practically eliminated and the reactor temperature was kept well below 300℃, within the operating temperature ranges of most Cu based catalysts. The new design was verified through simulation and experiments.