Advanced metal catalyst for a single stage water-gas shift reaction

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In recent years, the water-gas shift (WGS) reaction has been widely investigated in fuel cell technology. In a fuel processor, the two-stage WGS reactor occupies a large volume of ca. 70 vol.% of the whole system. This is a problem to be overcome for mobile and automotive fuel processors. For the miniaturization of portable fuel processor systems, advanced medium-temperature shift (MTS) catalysts applicable to a single-stage WGS reaction have been investigated. However, as most MTS catalysts are ceramic-based catalysts with low thermal conductivity, the heat of the WGS reaction cannot be released rapidly to the reactor wall from the catalyst surface, leading to the generation of hot spots and difficulties in enabling efficient operation close to the thermodynamic equilibrium. The metal catalyst has been considered for exothermic reactions because of its high heat-conductivity that facilitates the control of the heat of reaction to be maintained with the isothermal conditions into the catalyst bed. In this study, a comparative study has been performed to investigate the effectiveness of a metal catalyst before and after impregnation with potassium for a single stage water-gas shift (WGS) reaction.