Comparative numerical analysis on membrane steam methane reforming over catalyst bed and catalyst wash coated reactor

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Steam methane reforming (SMR) is getting high interest as it is the main production process of hydrogen, worldwide. In this study, CFD model was conducted to analyze the membrane steam methane reforming (MSMR) over Ni/Al_2O_3 catalyst in a rectangular channel adopting a Pd membrane for hydrogen separation. The effects of two catalysts, which were used for reaction activation, are modelled and compared. In the first type, the wash coated catalyst is fitted; while, in the second case, a catalyst bed is embedded. The results show that wash-coated catalyst does not promote the water gas shift reaction compared to the catalyst bed case due to the low catalyst load. The methane conversion and hydrogen yield were equal to 48.4% and 21.5%; respectively, in the case of the wash coated catalyst. While, in the case of the catalyst bed, the methane conversion is equal to 54.5% and 24% of hydrogen yield. On the other hand, the hydrogen separation is almost similar.