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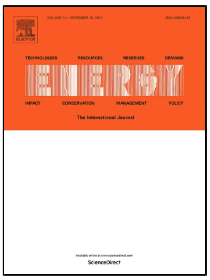

Computational fluid dynamic simulation of a sorption-enhanced palladium membrane reactor for enhancing hydrogen production from methane steam reforming

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Computational fluid dynamic simulation of a sorption-enhanced palladium membrane reactor for enhancing hydrogen production from methane steam reforming

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Abstract

To understand the reaction process of methane steam reforming in a sorption enhanced membrane reactor (SEMR), a computational fluid dynamic (CFD) model was developed to simulate the methane (CH_4) steam reforming in a palladium-based membrane reactor using a Ni-based catalyst and Na_2ZrO_3 CO_2 sorbent. The CFD model gained the insight of details in the reactor which could not be obtained by experiment. With the detailed information, this model detected the difference of reaction kinetics and fluid dynamic conditions in a SEMR and a traditional membrane reactor (MR). The comparison suggests that sorption-enhanced membrane reactor not only decreases CO_2 fraction, but also improves hydrogen (H_2) production by increasing reaction rates, CH_4 conversion and H_2 yield. The poisoning effect of carbon monoxide (CO) on the palladium membrane can also be minimized by reduced CO