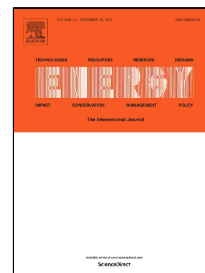


# Accepted Manuscript

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



Guozhao Ji, Ming Zhao, Geoff Wang

PII: S0360-5442(18)30110-5  
DOI: 10.1016/j.energy.2018.01.092  
Reference: EGY 12204  
To appear in: *Energy*  
Received Date: 18 February 2017  
Revised Date: 22 November 2017  
Accepted Date: 18 January 2018

Please cite this article as: Guozhao Ji, Ming Zhao, Geoff Wang, Computational fluid dynamic simulation of a sorption-enhanced palladium membrane reactor for enhancing hydrogen production from methane steam reforming, *Energy* (2018), doi: 10.1016/j.energy.2018.01.092

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

4 Guozhao Ji <sup>a</sup>, Ming Zhao <sup>a,\*</sup> and Geoff Wang <sup>b</sup>

5 <sup>a</sup> School of Environment, Tsinghua University, Beijing 100084, China

6 <sup>b</sup> School of Chemical Engineering, the University of Queensland, Brisbane, Qld 4072,  
7 Australia

8 \* Corresponding Author. Tel: +86 10 62784701. Email: ming.zhao@tsinghua.edu.cn

9 **Abstract**

10 To understand the reaction process of methane steam reforming in a sorption  
11 enhanced membrane reactor (SEMR), a computational fluid dynamic (CFD) model  
12 was developed to simulate the methane (CH<sub>4</sub>) steam reforming in a palladium-based  
13 membrane reactor using a Ni-based catalyst and Na<sub>2</sub>ZrO<sub>3</sub> CO<sub>2</sub> sorbent. The CFD  
14 model gained the insight of details in the reactor which could not be obtained by  
15 experiment. With the detailed information, this model detected the difference of  
16 reaction kinetics and fluid dynamic conditions in a SEMR and a traditional membrane  
17 reactor (MR). The comparison suggests that sorption-enhanced membrane reactor not  
18 only decreases CO<sub>2</sub> fraction, but also improves hydrogen (H<sub>2</sub>) production by  
19 increasing reaction rates, CH<sub>4</sub> conversion and H<sub>2</sub> yield. The poisoning effect of carbon  
20 monoxide (CO) on the palladium membrane can also be minimized by reduced CO

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