

Direct Synthesis of Liquefied Petroleum Gas from Syngas over H-ZSM-5 Enwrapped Pd-based Zeolite Capsule Catalysts

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Currently, the global energy crisis and environmental contamination issues are greatly concerned all over the world. [1] Liquefied petroleum gas (LPG) is widely regarded as a promising candidate for fuel in household and industry fields since it is clean and renewable with advantages of high octane number of energy demand and easy storage. [2] LPG is mainly obtained during the exploitation of natural gas and crude oil from the earth or produced from refining petroleum, which both processes are considered as a by-product. Another progress for LPG synthesis is from syngas over a type of metal-zeolite hybrid catalyst, which highly attracted attention in recent years. [3, 4] In this report, different with the general hybrid catalyst, we want to design a core-shell-like zeolite capsule catalyst to realize LPG direct synthesis from syngas.

A facile synthesis route, named dual-layer crystal growth method, was utilized for preparing Pd-based zeolite capsule catalysts. The micrometer-sized zeolite capsule catalysts (Pd/SiO₂-SZ), with a core-shell structure, were prepared by this dual-layer crystal growth method: coating Silicalite-1 and H-ZSM-5 zeolite orderly as double shell to encapsulate Pd/SiO₂ core. Fig. 1 exhibited the cross-section SEM image of the prepared Pd/SiO₂-SZ zeolite capsule catalyst. We employed the prepared Pd/SiO₂-SZ zeolite capsule catalyst for the direct synthesis of LPG from syngas.

This zeolite capsule catalyst showed excellent LPG selectivity than the single core catalysts Pd/SiO₂ or the physical mixture catalysts prepared by simply mixing core and shell catalysts. The Pd/SiO₂-SZ realized the highest LPG selectivity of 34.4 % with CO conversion of 14.1 %. Moreover, the Pd/SiO₂-SZ catalyst exhibited stable activity during 100 h time on stream reaction, as given by Fig. 2.

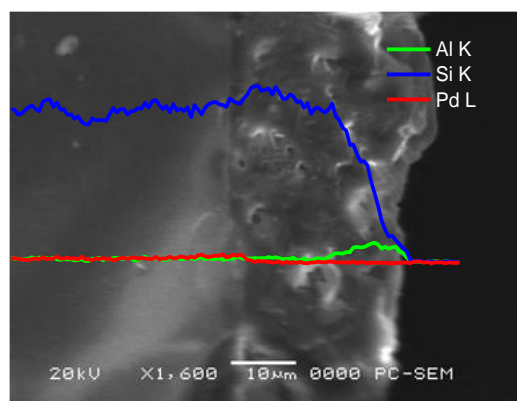


Fig.1 The cross-section SEM image of zeolite capsule catalyst Pd/SiO₂-SZ.

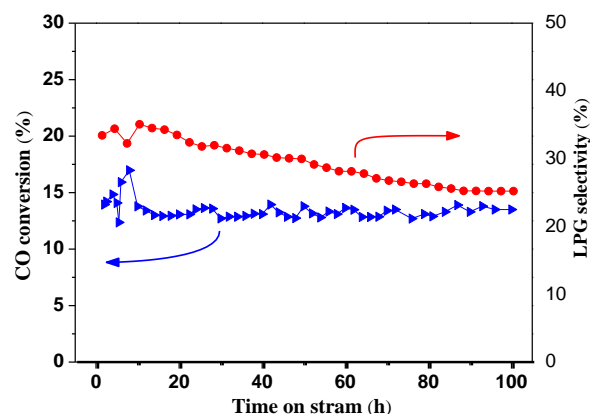


Fig. 2 Time on stream result of Pd/SiO₂-SZ on CO conversion and LPG selectivity.

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