Oxide-Zeolite Core-Shell Catalysts: Engineering an Interface for Selective CO_2 to Light Olefins Conversion

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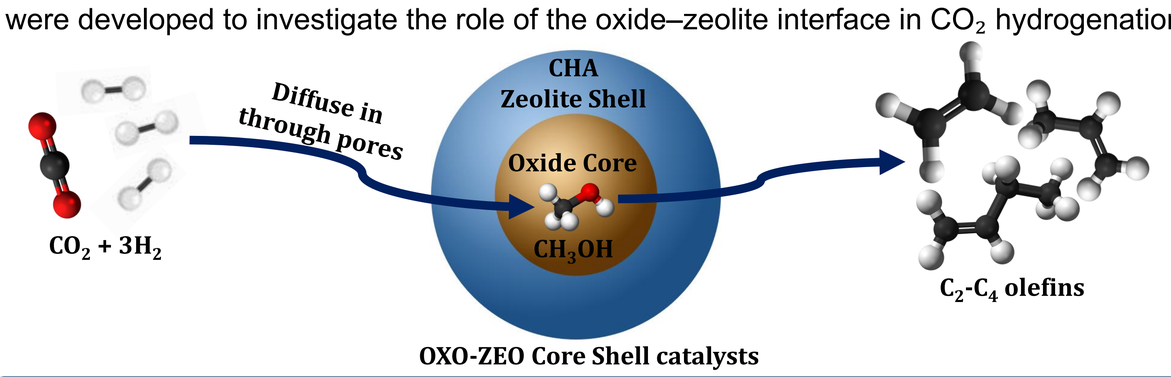
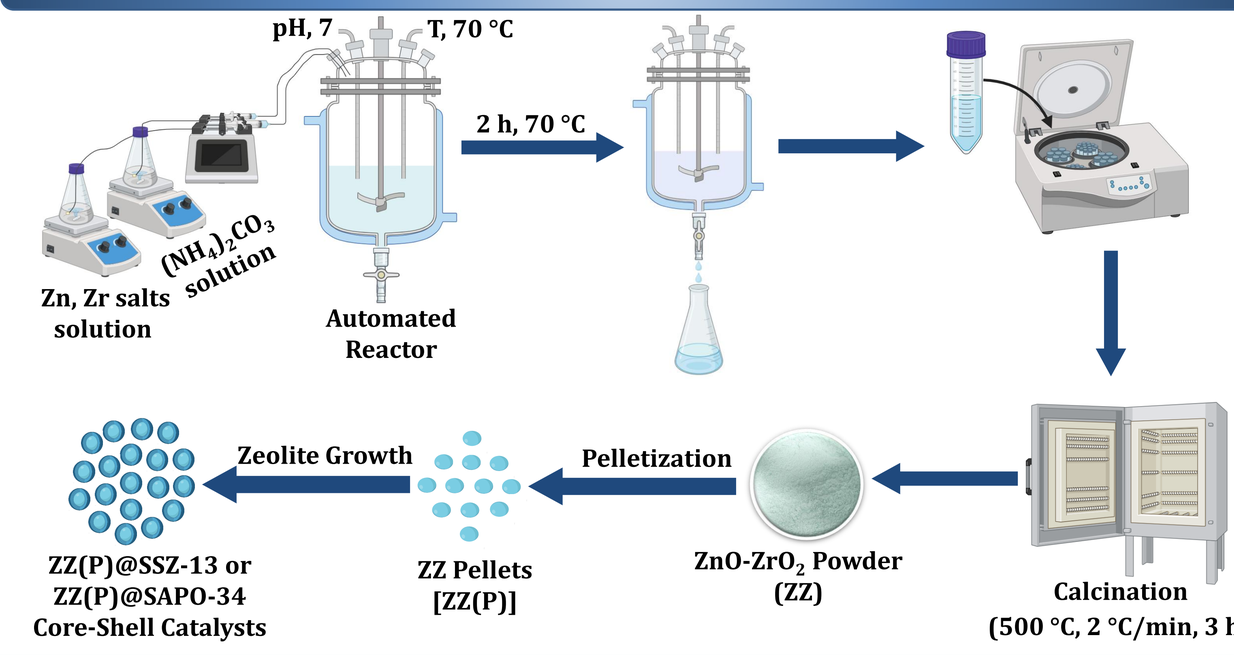
Introduction

Oxide–zeolite bifunctional catalysts are promising systems for the direct conversion of CO_2 into light olefins. The oxide phase promotes CO_2 activation and oxygenate formation, while CHA-type zeolites (SSZ-13 and SAPO-34) favour C_2–C_4 olefin production through their shape-selective pore structure. The core–shell structure enhances oxide–zeolite proximity and intermediate transport. Here, ZnO–ZrO_2@CHA-zeolite core–shell catalysts were developed to investigate the role of the oxide–zeolite interface in CO_2 hydrogenation.



Synthesis



Results & Discussions

Characterizations of the catalysts

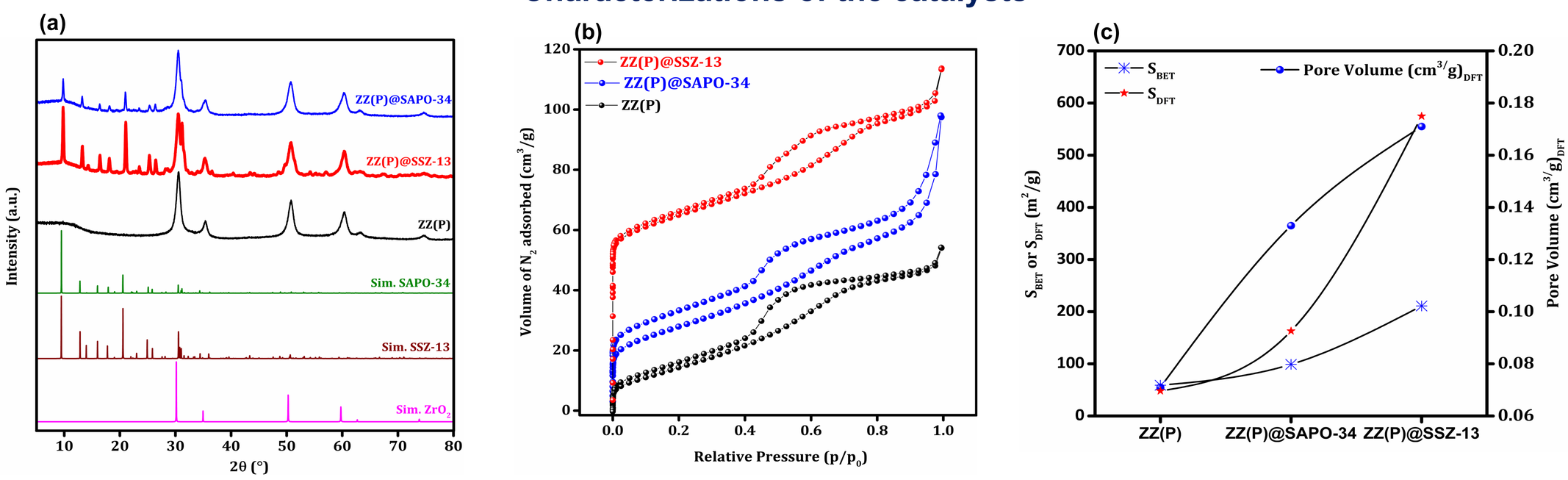


Fig. 1. XRD patterns (a), N_2 adsorption-desorption isotherms (b), and textural properties (c) of ZZ(P), ZZ(P)@SAPO-34, and ZZ(P)@SSZ-13.

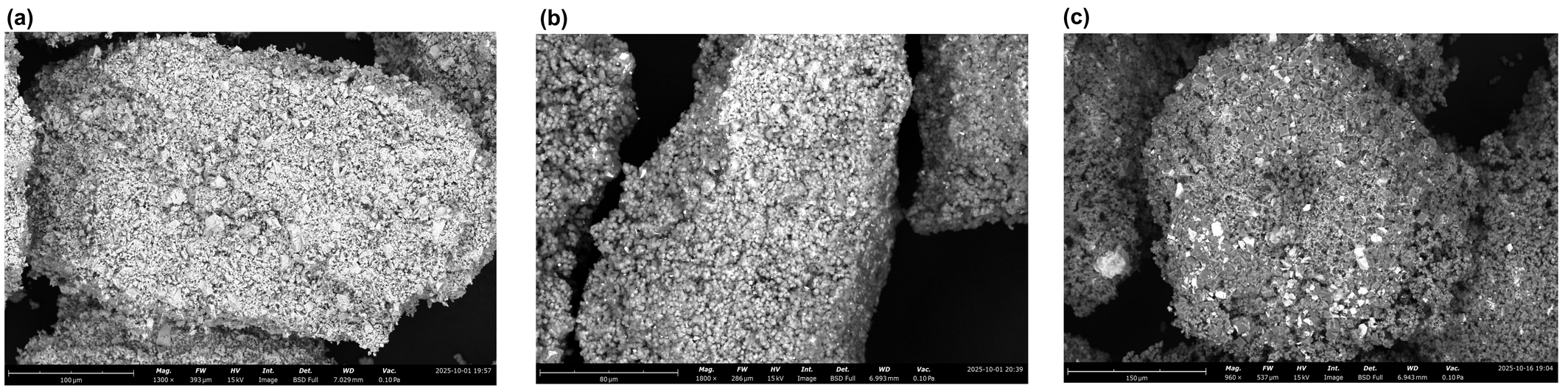


Fig. 2 SEM images of ZZ(P) (a), ZZ(P)@SAPO-34 (b) and ZZ(P)@SSZ-13 (c)

Activity Tests

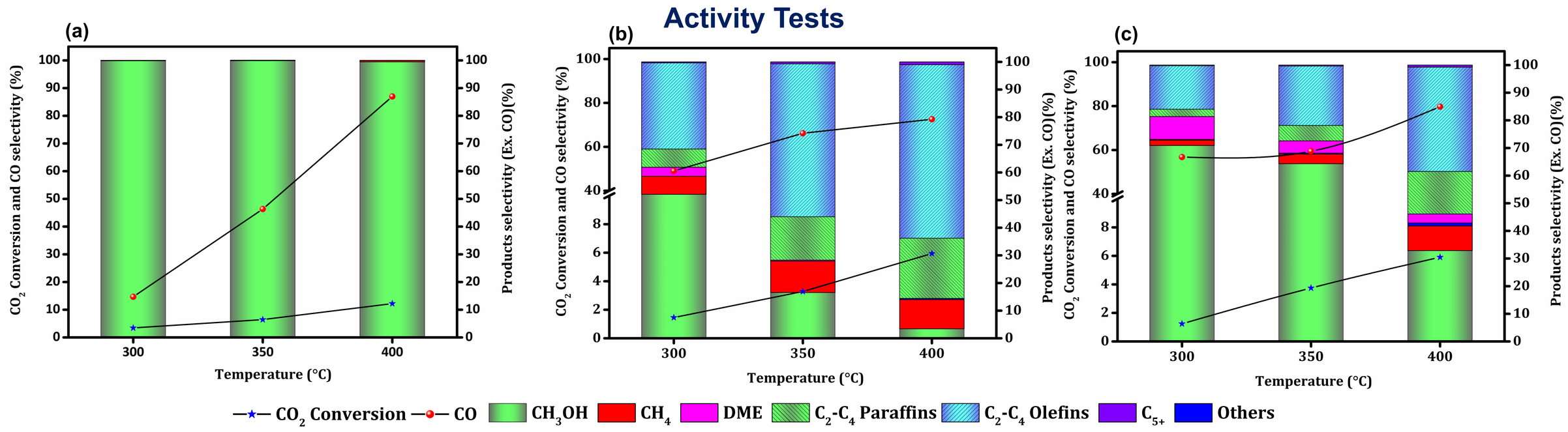


Fig. 3 The CO_2 hydrogenation activity over ZZ(P) (a), ZZ(P)@SAPO-34 (b) and ZZ(P)@SSZ-13 (C) catalysts
[Reaction conditions: H_2:CO_2 ratios: 3:1, Pressure:30 bar, Gas Space Hour Velocity (GHSV): 16000 ml h^{-1} g_{cat}^{-1}]

Conclusions & Outlook

- Core-shell ZZ(P)@SAPO-34 and ZZ(P)@SSZ-13 catalysts were successfully synthesized.
- Initial catalytic results suggest that the zeolite shell affects CO_2 hydrogenation product selectivity.
- The influence of shell composition and interface properties requires further investigation.
- Ongoing work focuses on optimizing synthesis parameters and improving catalytic performance toward light-olefin production.

Acknowledgments

This work was supported by the European Union's The European Innovation Council (EIC) program through the MemCat Project under grant agreement no. 101130047.

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