

Sm-CeO₂/Zeolite Bifunctional Catalyst for Direct and Highly Selective Conversion of Bioethanol to Propylene

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Abstract: A series of Sm-CeO₂/Beta composites with various Beta contents were prepared by an incipient impregnation method, followed by calcination at 650 °C. They were characterized by XRD, N₂ adsorption, SEM, NH₃-TPD, CO₂-TPD and ²⁷Al MAS NMR. The Sm-CeO₂/Beta bifunctional catalysts exhibit eminent catalytic performances in the selective conversion of ethanol to propylene. In particular, the Sm-CeO₂/10%Beta catalyst with 10% Beta zeolite gives the highest C₃H₆ yield of 59.3%. A good match between Sm-CeO₂ and Beta accounts for its optimal result.

Keywords: bioethanol; Sm-CeO₂/Zeolite bifunctional catalyst; renewable propylene

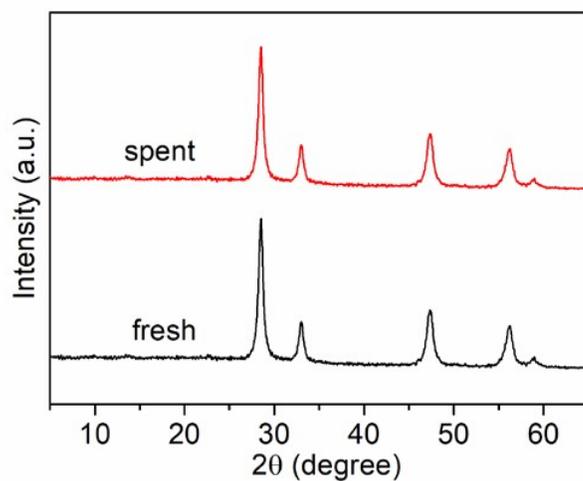


Figure S1. XRD patterns of SmCe/10%Beta before and after the stability test.

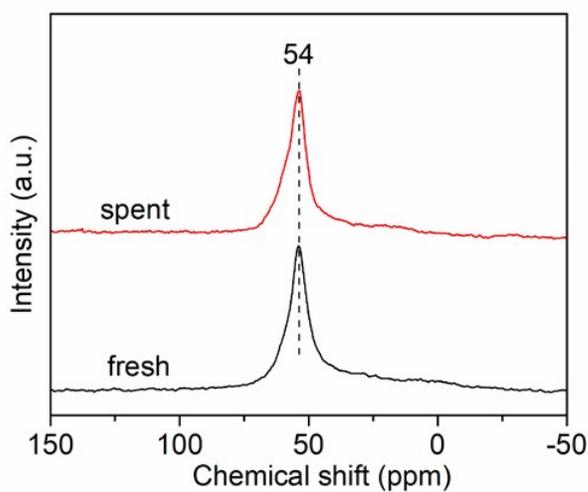


Figure S2. ^{27}Al MAS NMR spectra of the SmCe/10%Beta catalyst before and after the stability test.

Table S1. Propylene yield of some catalysts for the ETP reaction in reported literature ^a.

Catalyst	Weight (g)	Temp. (°C)	Space velocity (h ⁻¹)	Yield (%) ^b	Stability	Reference
Sm-CeO ₂ /Beta	0.3	440	WHSV = 0.52	59	maintain for 120 h	this work
P modified HZSM-5	0.3	550	WHSV = 6	32	maintain for 6 h	5
F modified HZSM-5	0.3	500	WHSV = 10	25	~18% after 80 h	12
Y-CeO ₂	2.0	430	WHSV = 0.43	30	maintain for 56 h	13
Y-ZrO ₂	0.72	450	WHSV = 0.91	44 ^c	–	16
Sc-In ₂ O ₃ /Beta	0.8	460	WHSV = 0.2	50	maintain for 60 h	18
ZnCeO _x /Beta	1.1	450	GHSV = 670	55	~50% after 30 h	19

^a The ethanol conversion is 100%. P = 0.1 MPa; ^b Initial propylene yield; ^c P = 1.11 MPa.