

Well-Dispersed MgAl_2O_4 Supported Ni Catalyst with Enhanced Catalytic Performance and the Reason of Its Deactivation for Long-Term Dry Methanation Reaction

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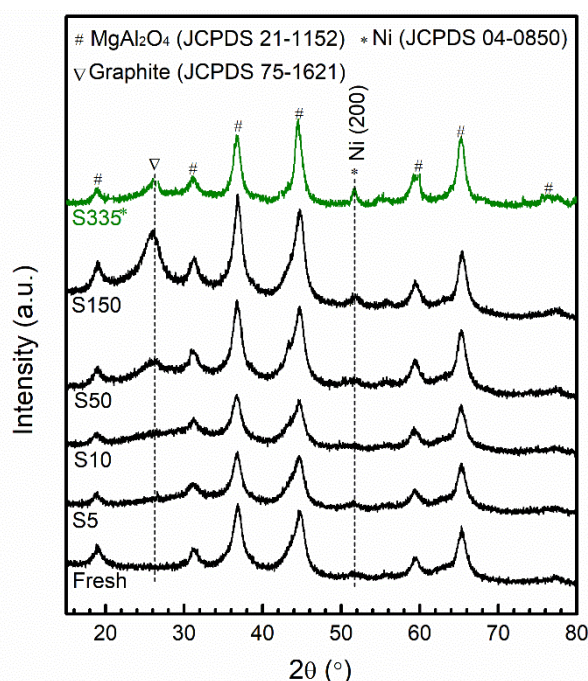


Figure S1. XRD patterns for the spent Ni/MgAl₂O₄-E catalysts.

Table S1. CO conversions, product selectivities and carbon balances for dry methanation reaction over Ni/MgAl₂O₄-E catalyst at different temperatures with GHSV of 10,000 mL h⁻¹ g_{cat}⁻¹.

Temperature (°C)	X _{CO} (%)	S _{CH₄} (%)	S _{CO₂} (%)	C _{balance} (%)
350	51.5	61.9	33.8	97.7
400	91.6	49.6	46.6	96.5
450	89.6	50.0	46.9	97.3
500	82.0	49.8	46.3	96.8
550	70.4	48.3	44.7	95.1

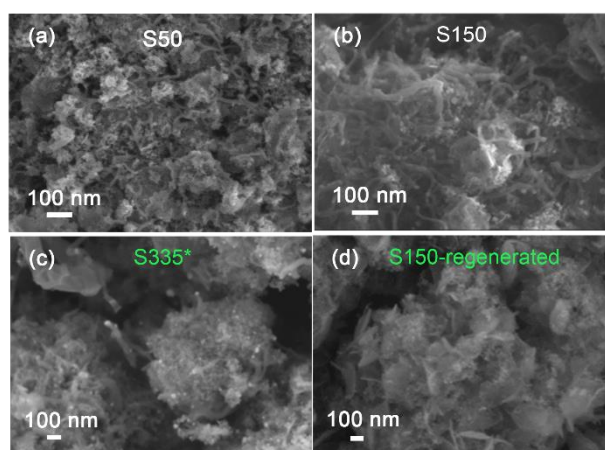


Figure S2. SEM images for the spent Ni/MgAl₂O₄-E catalysts: (a) Ni/MgAl₂O₄-S50, (b) Ni/MgAl₂O₄-S150, (c) Ni/MgAl₂O₄-S335* and (d) after reaction for 150 h followed by regeneration.

Table S2. Metallic Ni content, metallic Ni and graphitic carbon crystallite size and weight loss during TG of Ni/MgAl₂O₄-E catalyst after different reaction time.

Sample	Ni content (wt.%)	d_{Ni} (200) (nm)	d_{Graphite} (002) (nm)	Weight losses* (%)
Fresh	5.0	5.6	-	-
Ni/MgAl ₂ O ₄ -S5	4.9	5.8	-	4.5
Ni/MgAl ₂ O ₄ -S10	5.0	5.7	-	5.0
Ni/MgAl ₂ O ₄ -S50	5.0	5.5	2.8	13.6
Ni/MgAl ₂ O ₄ -S150	5.2	6.4	2.9	28.3
Ni/MgAl ₂ O ₄ -S335*	5.1	12.3	2.8	11.4

*Weight losses obtained in the temperature range of 350 °C and 650 °C.

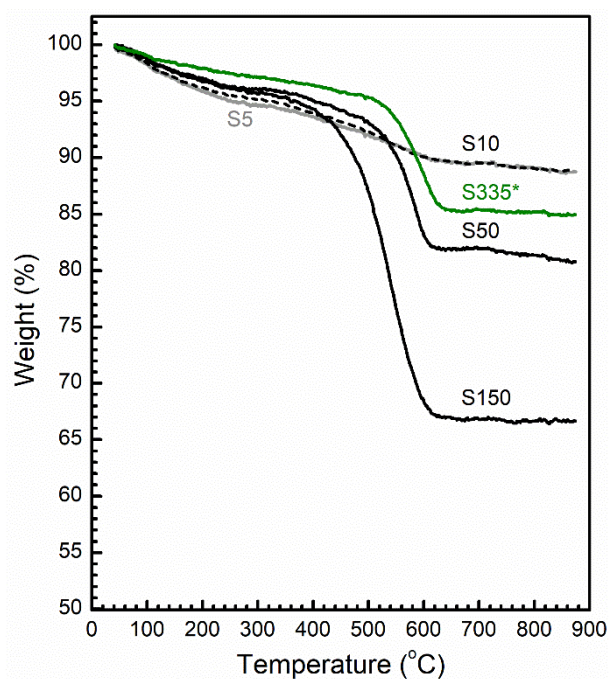


Figure S3. TG results for the spent Ni/MgAl₂O₄-E catalysts.

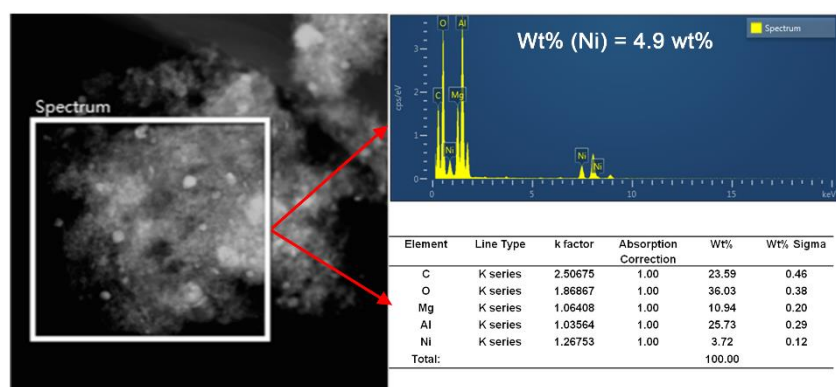


Figure S4. STEM-EDS images for the Ni/MgAl₂O₄-S335* catalyst.