Supplementary Information (SI) for Catalysis Science & Technology.

Synergistic Effects of Oxygen Vacancies and Schottky Junction in $Ni/CeNiO_{3-x}$ Catalysts for Photothermal CO_2 Methanation

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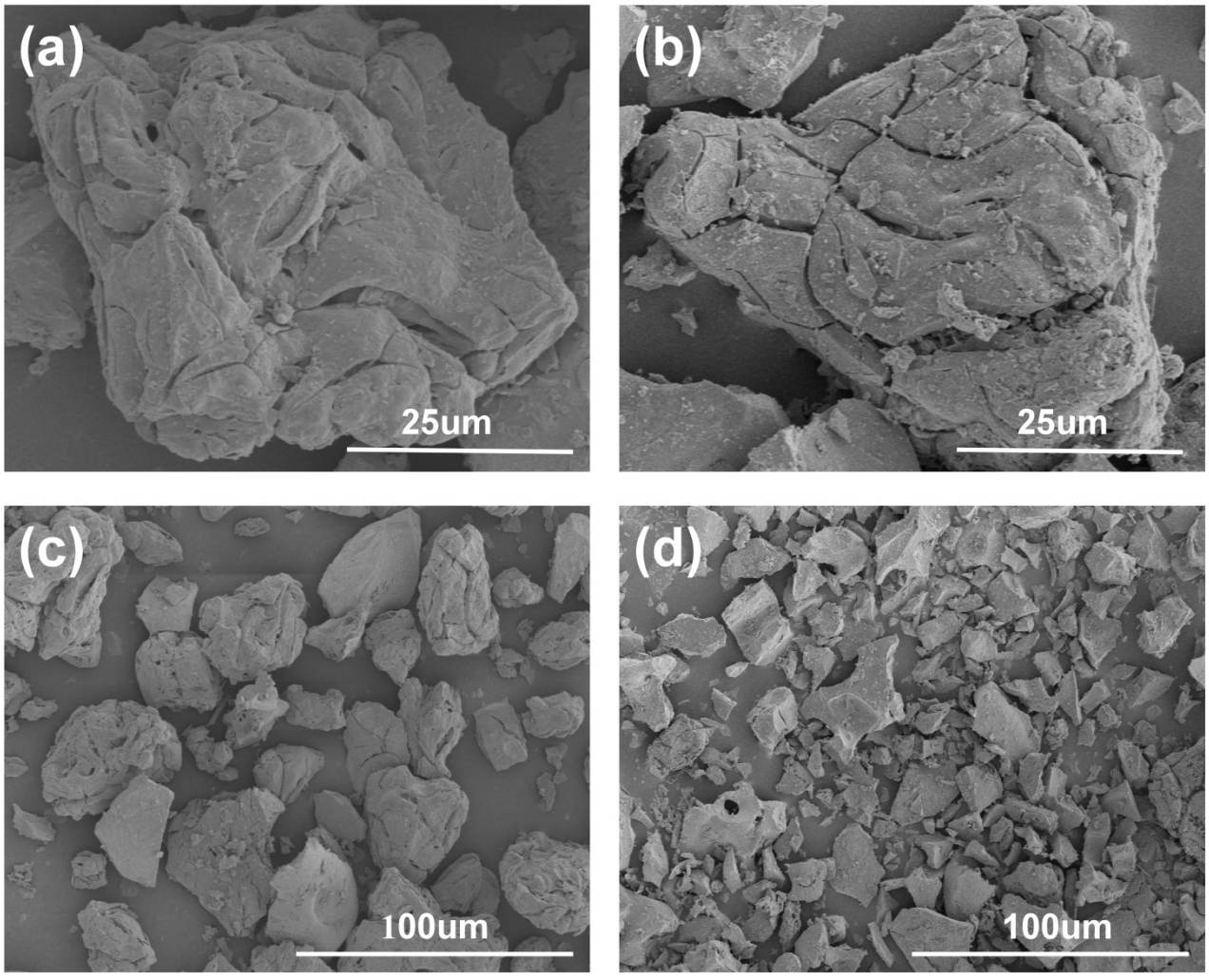

Fig. S1 SEM images of the catalysts: (a, c) $Ni/CeNiO_3$; (b, d) $Ni/CeNiO_{3-x}$.

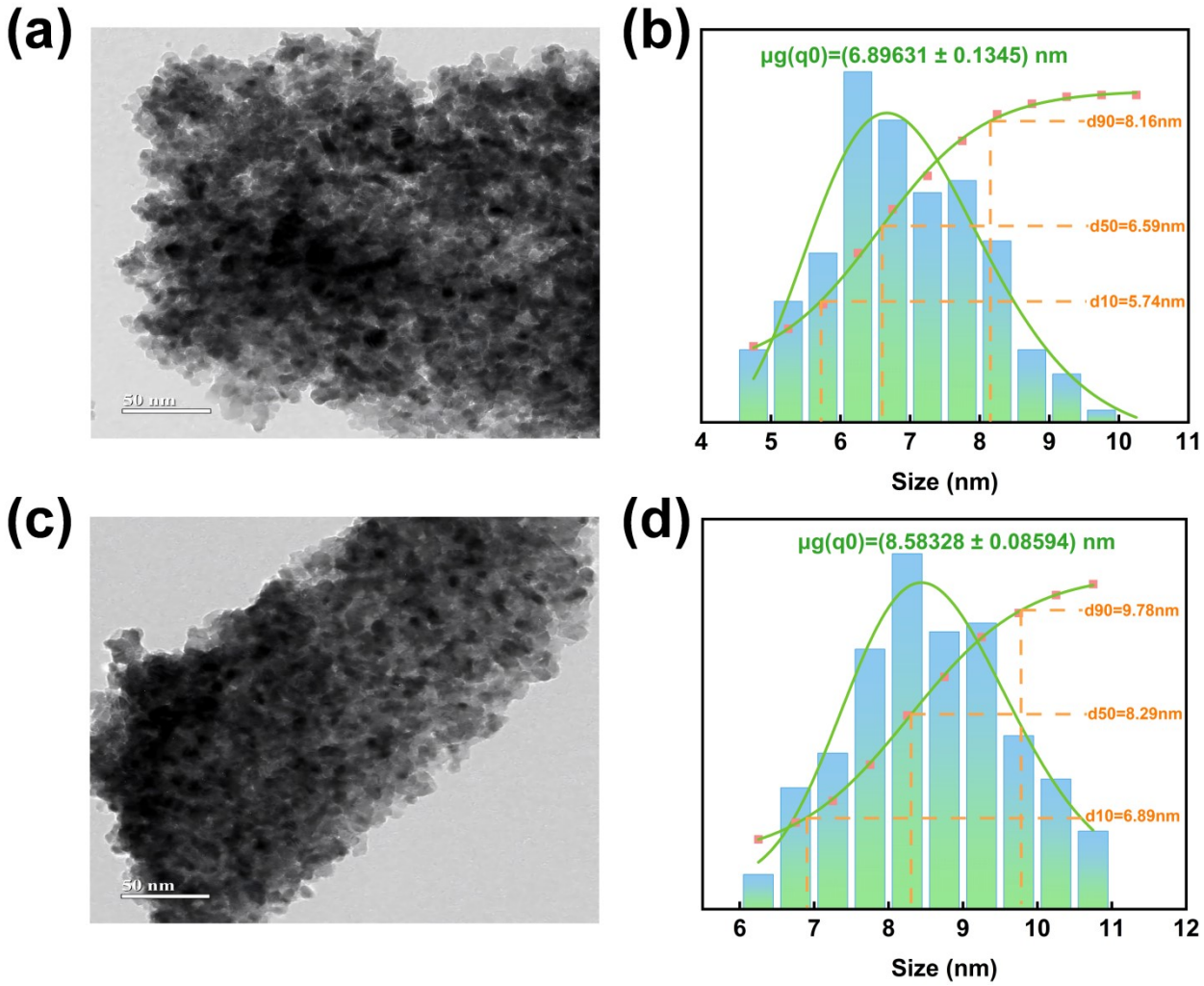

Fig. S2 Particle size distribution of $Ni/CeNiO_3$ and $Ni/CeNiO_{3-x}$ catalysts: (a, c) HRTEM images; (b, d) corresponding particle size distribution histograms.

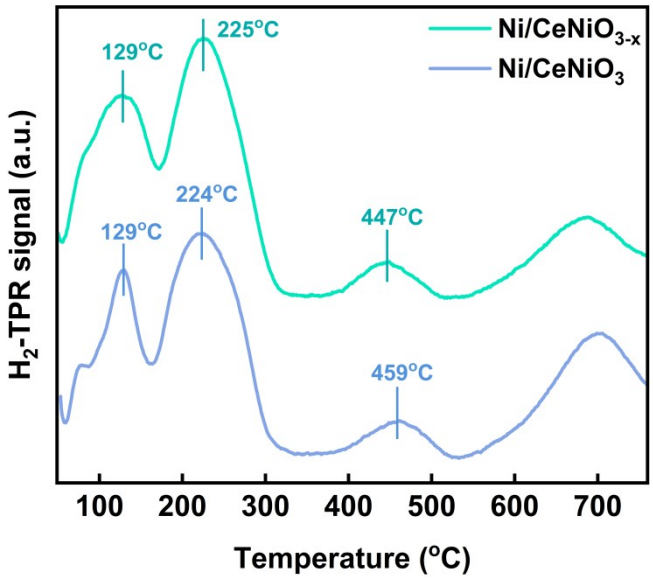

Fig. S3 H_2-TPR profiles of $Ni/CeNiO_3$ and $Ni/CeNiO_{3-x}$ catalysts.

The H_2-TPR measurements were conducted using a Micromeritics Auto Chem II 2920 instrument.

The test conditions were as follows: a heating rate of 10 °C·min^{-1} from 50 to 800 °C under a 10% H_2/Ar gas flow of 80 mL·min^{-1}. The data were recorded by monitoring the signal from a thermal conductivity detector (TCD).

Table S1

Charge difference of the respective elements under light and dark conditions.

Element	After in dark(ev)	After in Light(ev)	Gap(ev)
Ce^{3+}	880.19/898.01	880.26/898.08	0.07/0.07
Ce^{3+}	884.52/902.89	884.59/902.82	0.07/0.07
Ce^{4+}	881.68/900.11	881.75/900.18	0.07/0.07
Ce^{4+}	888.32/906.68	888.39/906.76	0.07/0.08
Ce^{4+}	897.67/915.97	897.74/916.04	0.07/0.07
O_{latt}	528.75	528.82	0.07
O_{def}	530.66	530.73	0.07
O_{surf}	532.86	532.93	0.07
Ni^0	855.73	855.66	0.07
Ni^{2+}	854.27	854.20	0.07
Ni^{3+}	851.93	851.86	0.07

Table S2

Content of Ni under various conditions.

$Ni/CeNiO_{3-x}$	Ni^0	$Ni^{2+}+Ni^{3+}$
Unreacted	15.22	84.78
After PT	15.30	84.70
After T	14.49	85.51

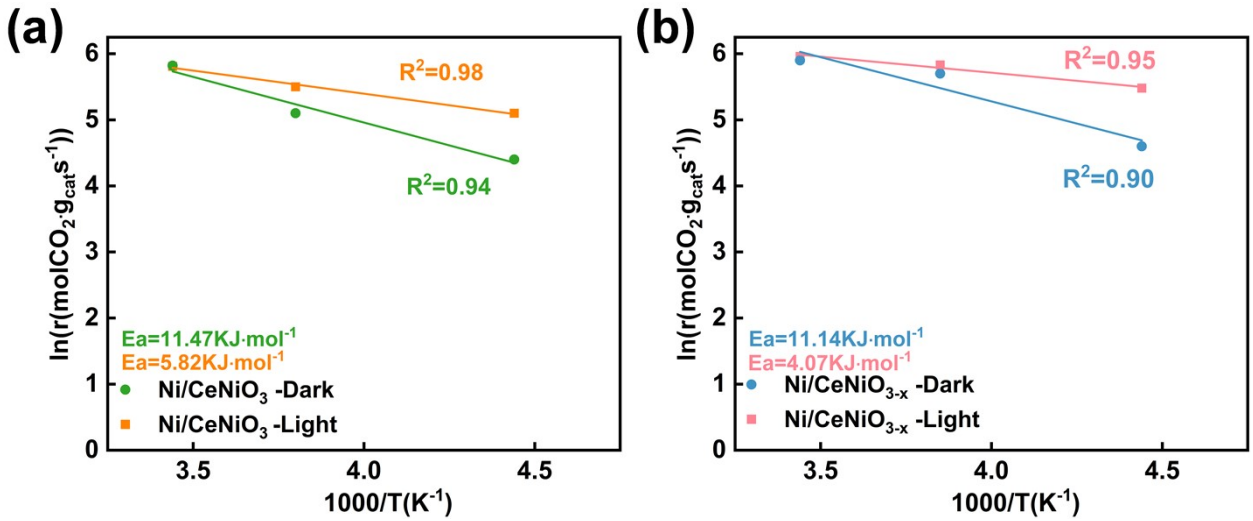

Fig. S4 Arrhenius plots of the $Ni/CeNiO_3$ and $Ni/CeNiO_{3-x}$ catalysts.

Table S3

Actual catalyst temperature under photothermal and thermal conditions

Theoretical temperature (°C)	$Ni/CeNiO_3$ Light (°C)	$Ni/CeNiO_{3-x}$ Light (°C)
150	150.1	151.6
200	201.3	202.1
250	253.8	254.8
300	303.2	301.9
350	352.4	352.7
400	401.4	402.6

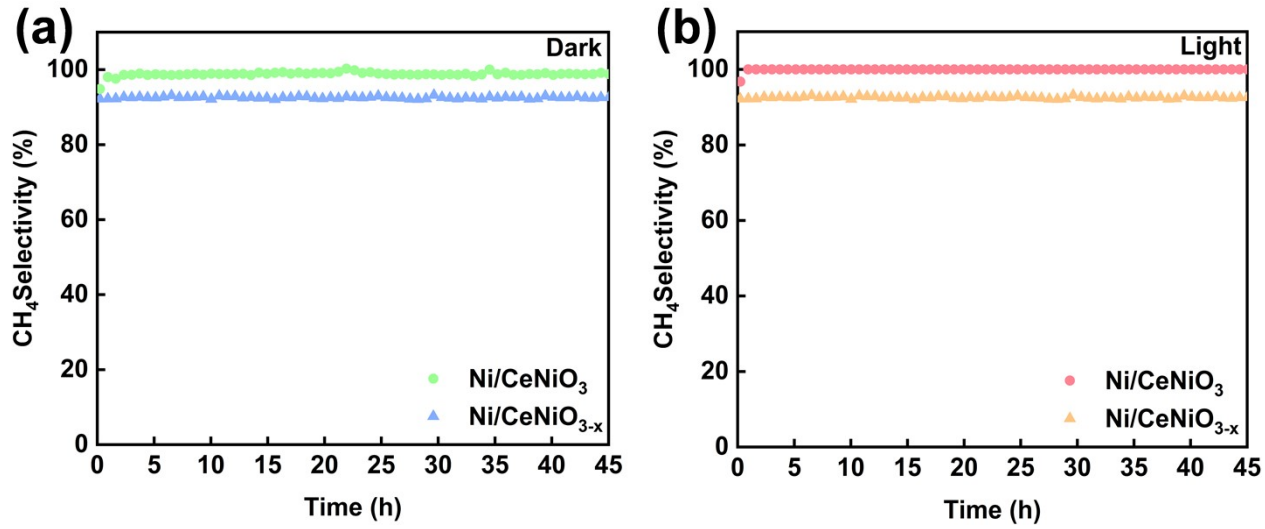

Fig. S5 Stability tests of the $Ni/CeNiO_3$ and $Ni/CeNiO_{3-x}$ catalysts at 250 °C under photothermal and thermal conditions.