

# RuNi/TiZr-MMO Catalysts Derived from Zr-Modified NiTi-LDH for CO-Selective Methanation

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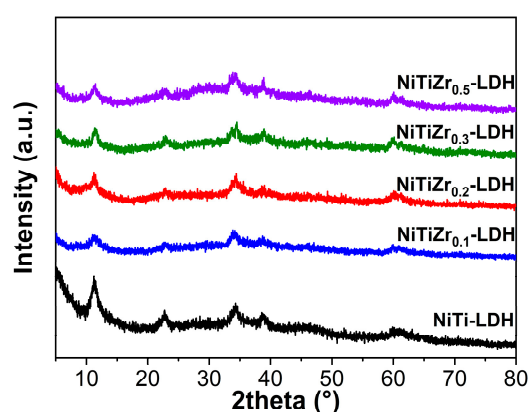


Figure S1. XRD patterns of NiTi-LDH and NiTiZr<sub>x</sub>-LDH (x = 0.1, 0.2, 0.3, 0.5) precursors.

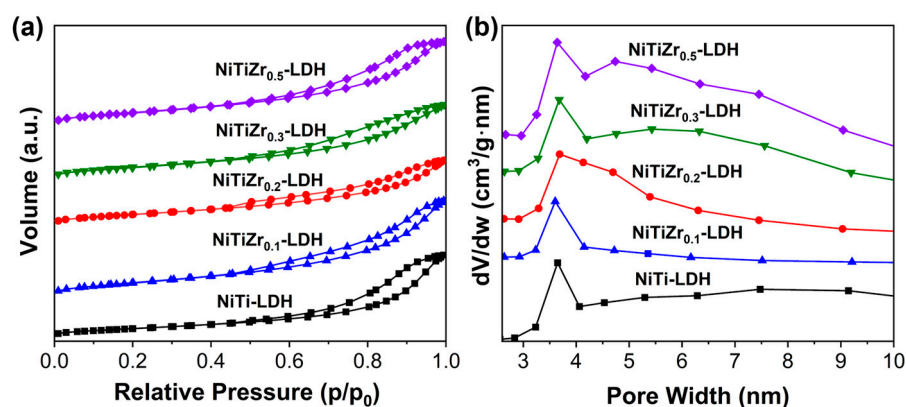
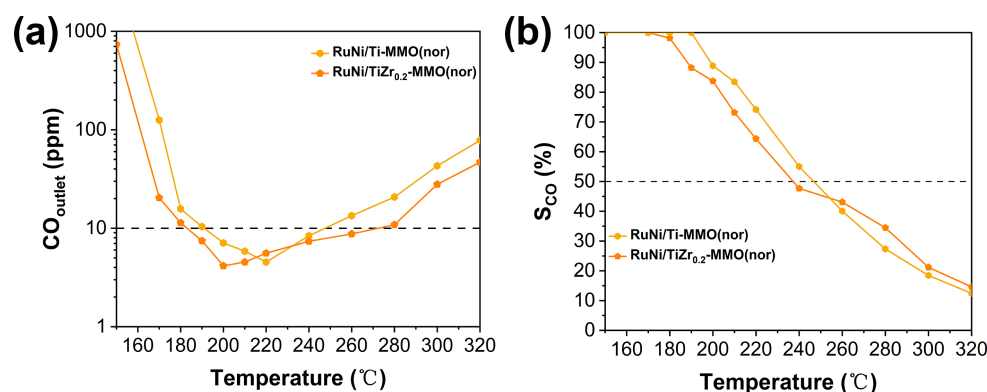


Figure S2. (a) N<sub>2</sub> adsorption–desorption curves and (b) pore size distribution of NiTi-LDH and NiTiZr<sub>x</sub>-LDH (x = 0.1, 0.2, 0.3, 0.5) precursors.



**Figure S3.** The outlet CO concentration (a) and the selectivity of CO methanation (b) over the RuNi/Ti-MMO(nor) and RuNi/TiZr<sub>0.2</sub>-MMO(nor) catalysts.

**Table S1.** The specific surface area and average pore size of NiTi-LDH and NiTiZr<sub>x</sub>-LDH ( $x = 0.1, 0.2, 0.3, 0.5$ ) precursors.

Catalyst	Surface area (m <sup>2</sup> ·g <sup>-1</sup> )	Average pore size (nm)
NiTi-LDH	288	11.6
NiTiZr <sub>0.1</sub> -LDH	342	7.8
NiTiZr <sub>0.2</sub> -LDH	441	8.9
NiTiZr <sub>0.3</sub> -LDH	389	7.9
NiTiZr <sub>0.5</sub> -LDH	411	8.5

**Table S2.** The size of the Ni estimated by Scherrer equation of RuNi/Ti-MMO and RuNi/TiZr<sub>0.2</sub>-MMO.

Catalyst	D <sub>Ni</sub> (nm)
RuNi/Ti-MMO	11.2
RuNi/TiZr <sub>0.2</sub> -MMO	6.5

**Table S3.** Summary of the CO-SMET performances of the Ru- and Ni-based catalysts reported previously.

Catalyst	[CO] <sub>min</sub> (ppm)	SWTW <sup>1</sup>	Stability (h)	Reference
RuNi/TiZr <sub>0.2</sub> -MMO	<10	180~280	120	In this work
Ru-Ni/Al <sub>2</sub> O <sub>3</sub>	<100	*	-	[18]
RuNi/MMO	<10	180~260	120	[34]
RuNi/GA-MMO	<10	220~300	120	[37]
NiAl-Na	-	240~320	100	[53]
Ru-Ni/Al <sub>2</sub> O <sub>3</sub>	11	*	80	[54]
Ni/TiO <sub>2</sub>	1000	*	-	[55]
Ru-Ni/TiO <sub>2</sub>	11	*	-	[56]
Ru-Ni/TiO <sub>2</sub> -Al <sub>2</sub> O <sub>3</sub>	<10	210~220	200	[57]
Ru/Ni-TNTs	<10	210~285	-	[58]
Ru/Ni-Al-oxide/NF	<10	200~260	120	[59]

<sup>1</sup> A suitable working temperature window, in which the CO concentration in the effluent less than 10 ppm and CO selectivity greater than 50%.

\* The catalyst did not meet the requirements.