Microwave-assisted deep eutectic solvent synthesis of Sr-doped $LaNiO_3$-derived Ni-based oxides for efficient NH_3 decomposition

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Physical characterization

The crystal structure of catalyst was characterized by X-ray diffraction (XRD, D8 Advance, Bruker). The morphology of catalyst was analyzed using scanning electron microscopy (SEM, S-4800, Hitachi) and high-resolution transmission electron microscopy (HRTEM), high-angle annular dark field scanning transmission electron microscopy (HADDF-STEM), and energy dispersive X-ray spectroscopy (EDS) (JEM-2100F, JEOL). The textural property of catalyst was characterized by N_2 sorption (Autosob IQ-MP-MP). The reducibility and alkalinity of catalyst were characterized by hydrogen temperature programmed reduction (H_2-TPR) and CO_2 temperature programmed desorption (CO_2-TPD) (ChemStar, Quanta chrome Instruments), respectively. The surface information of catalyst was obtained using X-ray photoelectron spectrometry (XPS, Escalab 250Xi, Thermo Scientific). In-situ diffuse reflectance infrared Fourier transform spectroscopy (in-situ DRIFTs) measurements were conducted on a Nicolet iS50 spectrometer (Thermo Scientific).

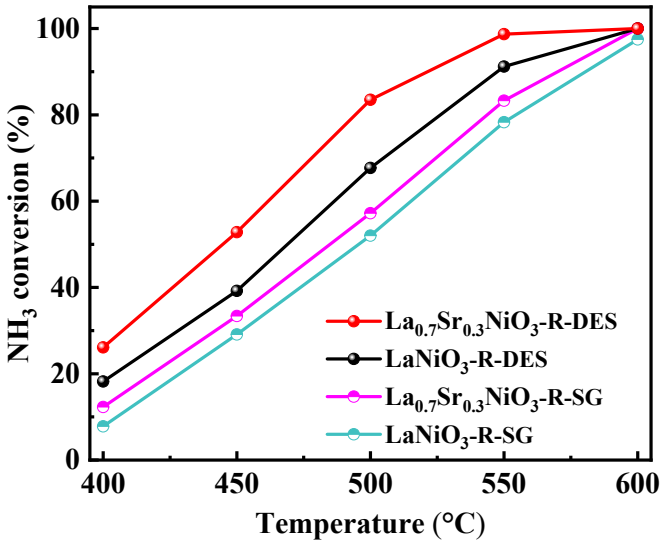

Fig. S1. Temperature-dependent NH_3 decomposition performance of $LaNiO_3$-R and $La_{0.7}Sr_{0.3}NiO_3$-R synthesized by the microwave-assisted DES and SG methods at a WHSV of 30,000 $mL \cdot g_{cat}^{-1} \cdot h^{-1}$.

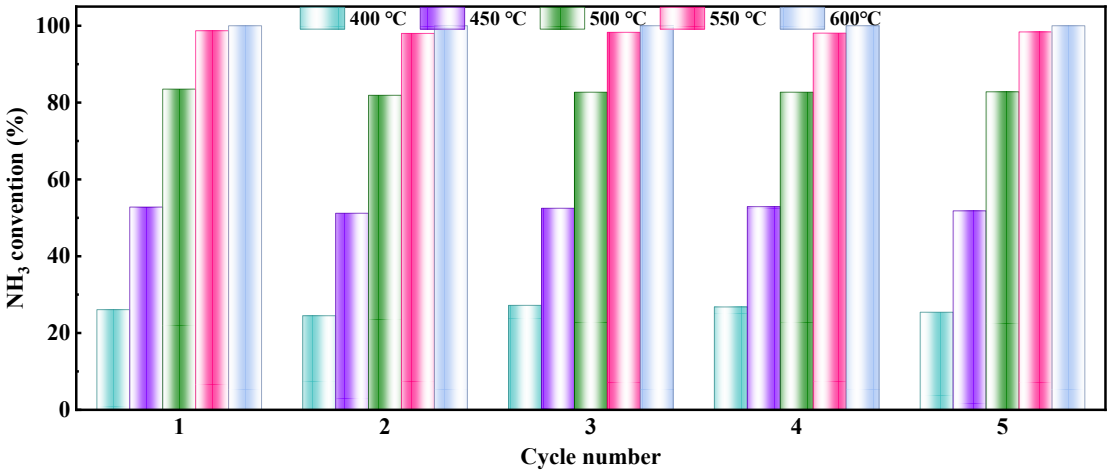

Fig. S2. The cyclic stability test of $La_{0.7}Sr_{0.3}NiO_3$-R catalyst (400–600 °C, WHSV = 30,000 $mL \cdot g_{cat}^{-1} \cdot h^{-1}$).

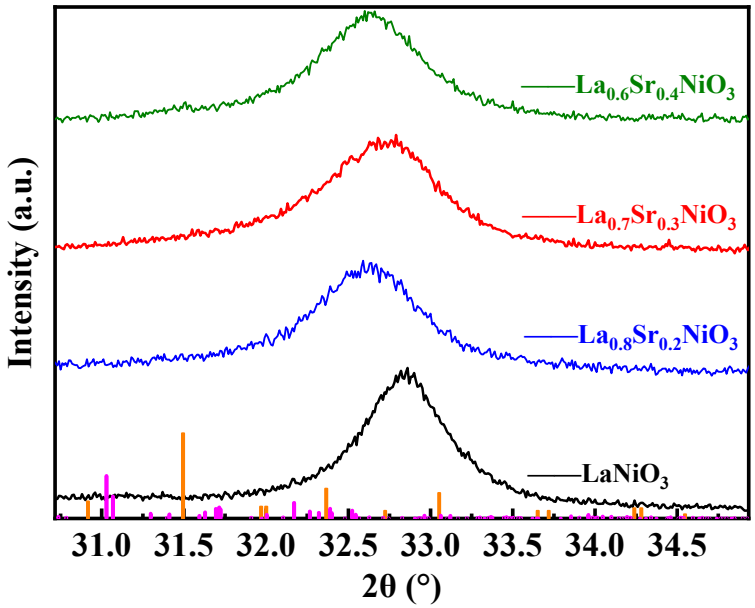

Fig. S3. Enlarged XRD patterns of $La_xSr_{1-x}NiO_3$ catalysts.

Table S1. Textural properties of $La_xSr_{1-x}NiO_3$ and $La_xSr_{1-x}NiO_3$-R.

Sample	S_{BET} ($m^2 \cdot g^{-1}$)	V_T ($cm^3 \cdot g^{-1}$)	Pore size (nm)
$LaNiO_3$	28	0.19	16
$La_{0.8}Sr_{0.2}NiO_3$	31	0.24	32
$La_{0.7}Sr_{0.3}NiO_3$	22	0.12	24
$La_{0.6}Sr_{0.4}NiO_3$	20	0.13	25
$LaNiO_3$-R	27	0.15	22
$La_{0.8}Sr_{0.2}NiO_3$-R	36	0.15	17
$La_{0.7}Sr_{0.3}NiO_3$-R	33	0.19	23
$La_{0.6}Sr_{0.4}NiO_3$-R	22	0.16	29

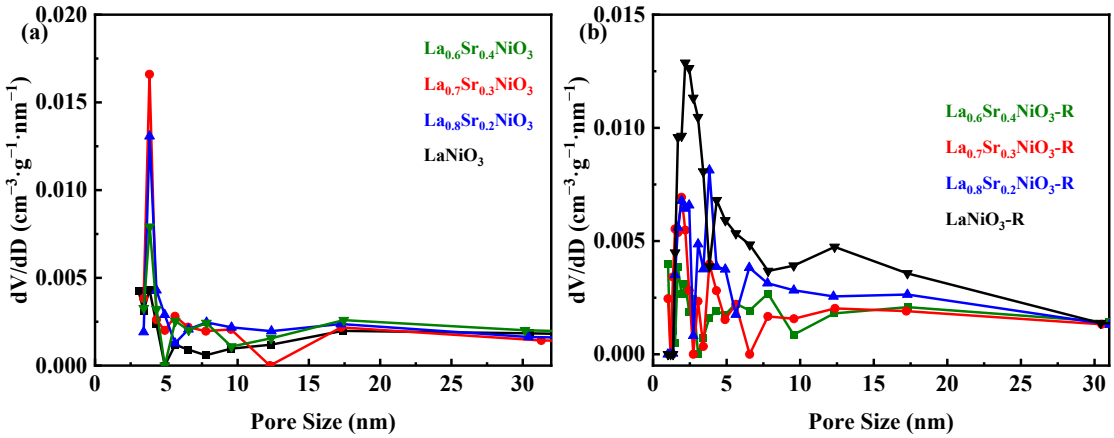

Fig. S4. Pore size distribution curves of $La_xSr_{1-x}NiO_3$ (a) and $La_xSr_{1-x}NiO_3$-R catalysts (b).

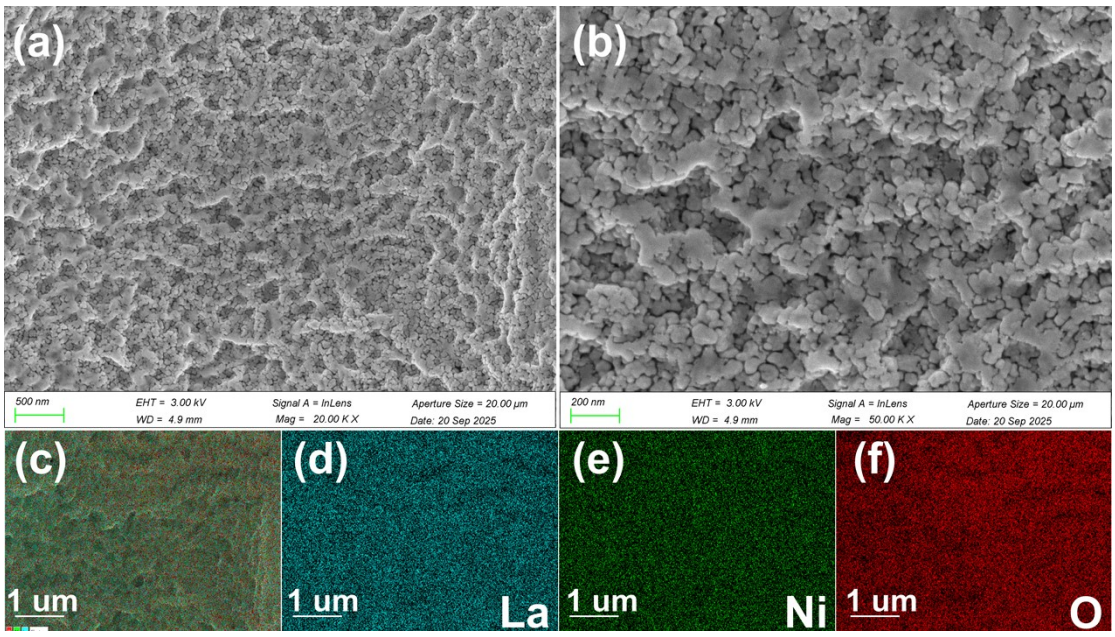

Fig. S5. SEM images of the $LaNiO_3$ catalyst at different magnifications: (a) 20,000× and (b) 50,000×, and the corresponding EDS elemental mapping images showing the distribution of (c) all detected elements, (d) O, (e) Ni, and (f) La.

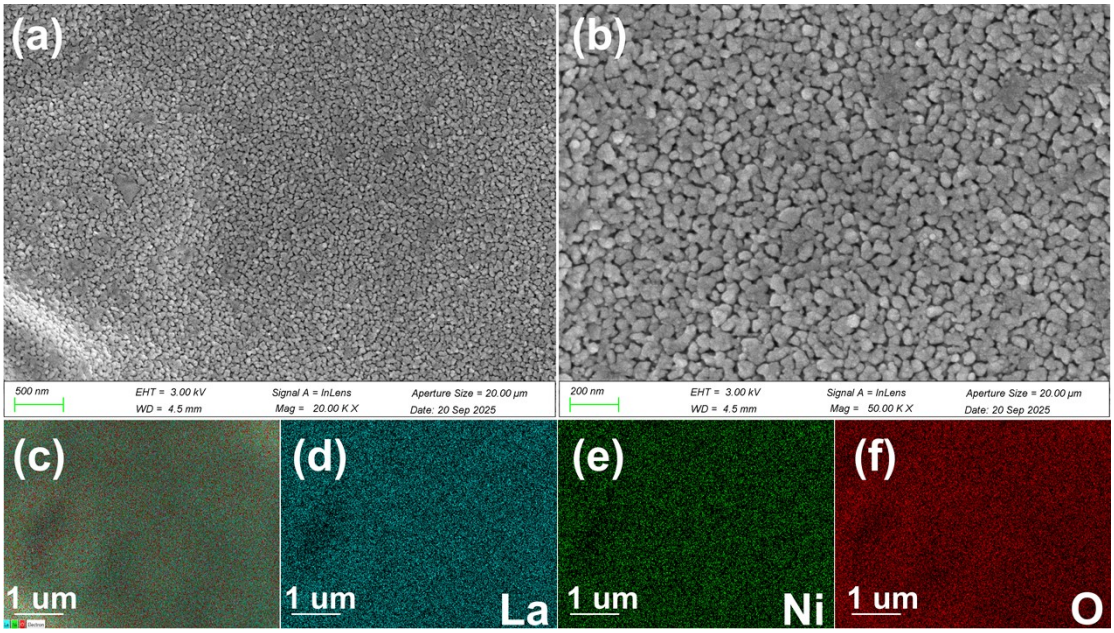

Fig. S6. SEM images of the $LaNiO_3$-R catalyst at different magnifications: (a) 20,000× and (b) 50,000×, and the corresponding EDS elemental mapping images showing the distribution of (c) all detected elements, (d) O, (e) Ni, and (f) La.

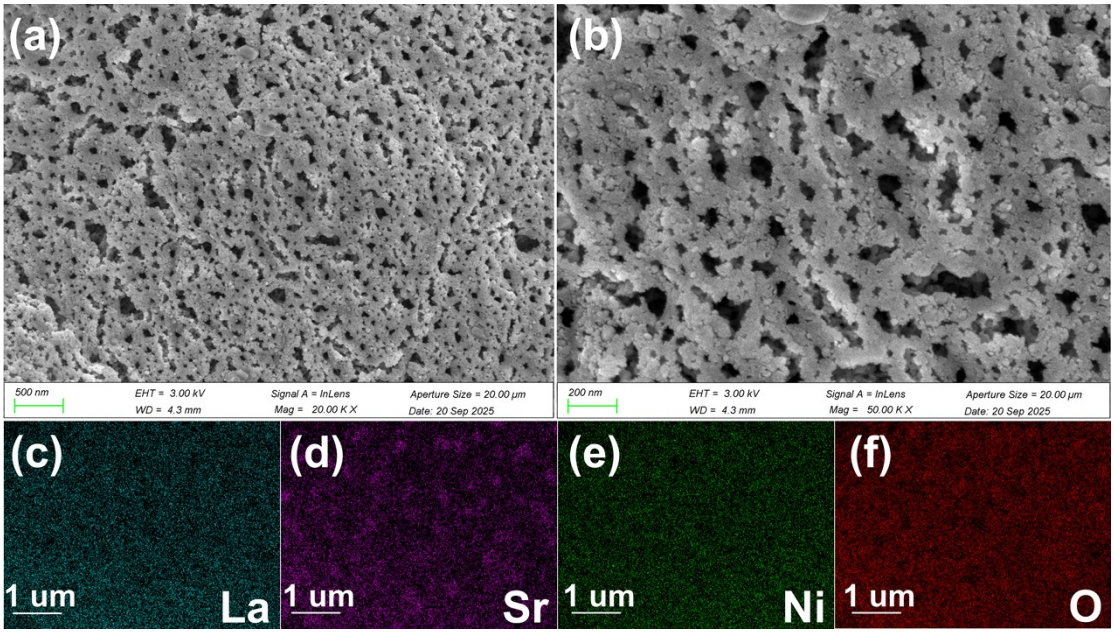

Fig. S7. SEM images of the $La_{0.7}Sr_{0.3}NiO_3$ catalyst at different magnifications: (a) 20,000× and (b) 50,000×, and the corresponding EDS elemental mapping images showing the distribution of (c) Sr, (d) O, (e) Ni, and (f) La.

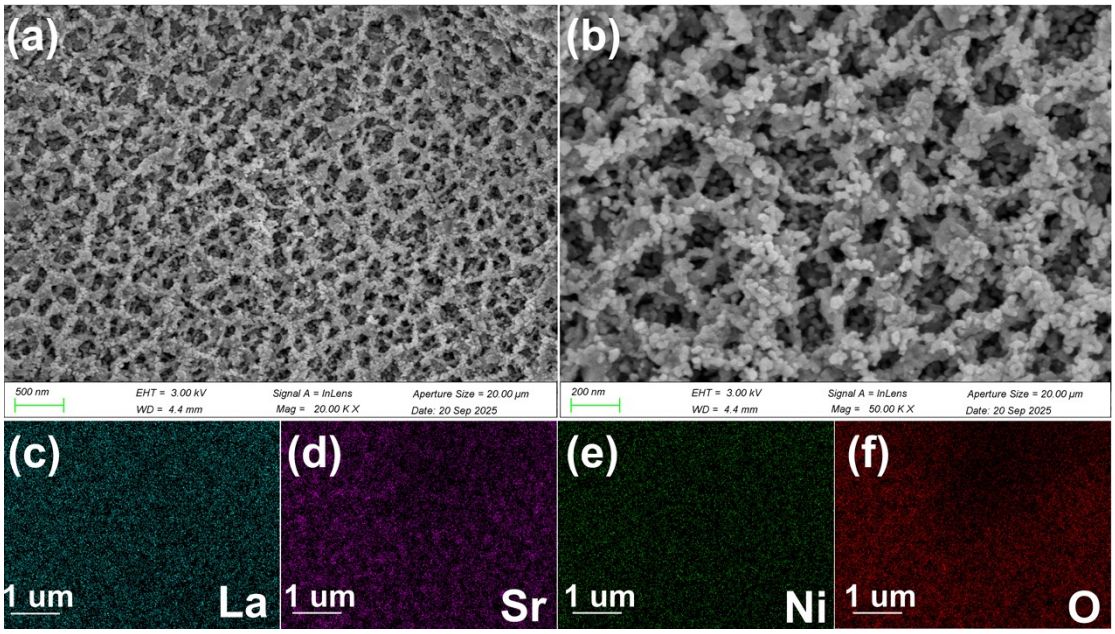

Fig. S8. SEM images of the $La_{0.7}Sr_{0.3}NiO_3$-R catalyst at different magnifications: (a) 20,000× and (b) 50,000×, and the corresponding EDS elemental mapping images showing the distribution of (c) Sr, (d) O, (e) Ni, and (f) La.

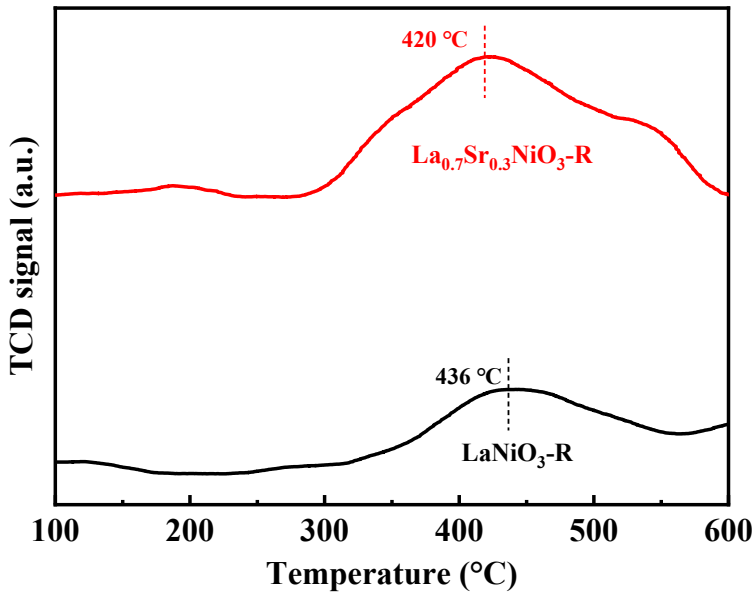

Fig. S9. N_2-TPD results for $LaNiO_3$-R and $La_{0.7}Sr_{0.3}NiO_3$-R catalysts.

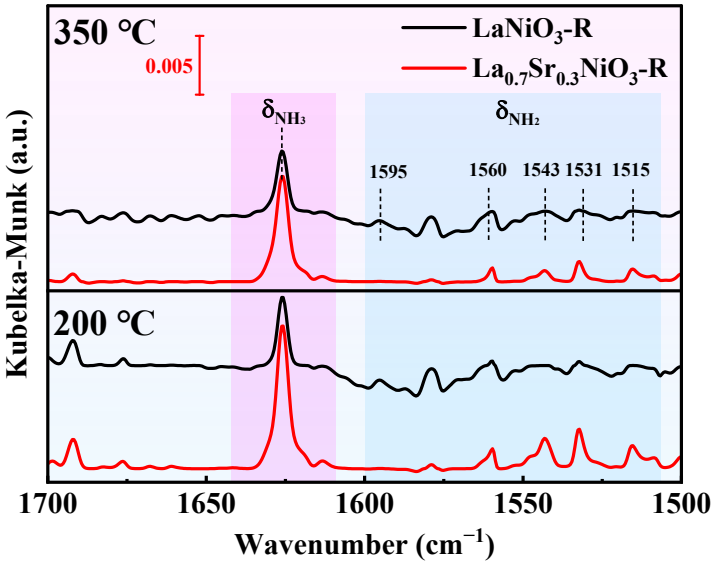

Fig. S10. Comparison of the in situ DRIFTS spectra of $LaNiO_3$-R and $La_{0.7}Sr_{0.3}NiO_3$-R catalysts at 200 and 350 °C.