

Supporting Information

Ambient Pressure Synthesis of Unstable Bulk Phases of Strongly Correlated Rare-Earth Nickelates

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Table S1. Summary of the fitting results of the Rietveld refinement of XRD patterns reported in the manuscript.

	Figure	Rp (%)	Rwp (%)	Chi ²
SmNiO _x - As synthesized	1d	6.20	9.26	6.75
SmNiO _x - RT aged	3a	5.28	7.55	4.54
SmNiO _x - HT aged	3b	4.79	6.87	4.00
NdNiO _x - As synthesized	1c	3.58	4.64	1.90
NdNiO _x -RT aged	2a	5.22	6.79	2.68
NdNiO _x -HT aged	2b	6.88	9.48	5.41

Table S2. Summary of XPS fitting analysis of Ni 2p_{3/2} peak of NdNiO_x and SmNiO_x before and after aging done using the multiplet peaks of free Ni²⁺ and Ni³⁺ ions, as reported by Biesinger *et al.*

SmNiO_x- As synthesized

<i>Peak ID</i>	<i>Energy (eV)</i>	<i>FWHM (eV)</i>	<i>%Area</i>
Ni ²⁺ - 1	853.7	1.0	36.79
Ni ²⁺ - 2	855.7	2.25	8.5
Ni ³⁺ - 3	854.6	1.4	25.75
Ni ³⁺ - 4	855.3	1.5	4.85
Ni ³⁺ - 5	855.7	1.4	14.77
Ni ³⁺ - 6	856.5	1.4	9.32

SmNiO_x- Aged-RT

<i>Peak ID</i>	<i>Energy (eV)</i>	<i>FWHM (eV)</i>	<i>%Area</i>
Ni ²⁺ - 1	853.7	1.0	21.99
Ni ²⁺ - 2	855.7	2.25	0.019
Ni ³⁺ - 3	854.6	1.4	28.69
Ni ³⁺ - 4	855.3	1.5	17.2
Ni ³⁺ - 5	855.7	1.4	11.47
Ni ³⁺ - 6	856.5	1.4	20.63

NdNiO_x- As synthesized

<i>Peak ID</i>	<i>Energy (eV)</i>	<i>FWHM (eV)</i>	<i>%Area</i>
Ni ²⁺ - 1	853.7	1.0	29.69
Ni ²⁺ - 2	855.7	2.25	1.49
Ni ³⁺ - 3	854.6	1.4	26.18
Ni ³⁺ - 4	855.3	1.5	12.67
Ni ³⁺ - 5	855.7	1.4	15.04
Ni ³⁺ - 6	856.5	1.4	14.92

NdNiO_x- Aged-RT

<i>Peak ID</i>	<i>Energy (eV)</i>	<i>FWHM (eV)</i>	<i>%Area</i>
Ni ²⁺ - 1	853.7	1.0	27.33

Ni ²⁺ - 2	855.7	2.25	0.85
Ni ³⁺ - 3	854.6	1.4	33.79
Ni ³⁺ - 4	855.3	1.5	8.55
Ni ³⁺ - 5	855.7	1.4	15.98
Ni ³⁺ - 6	856.5	1.4	13.49

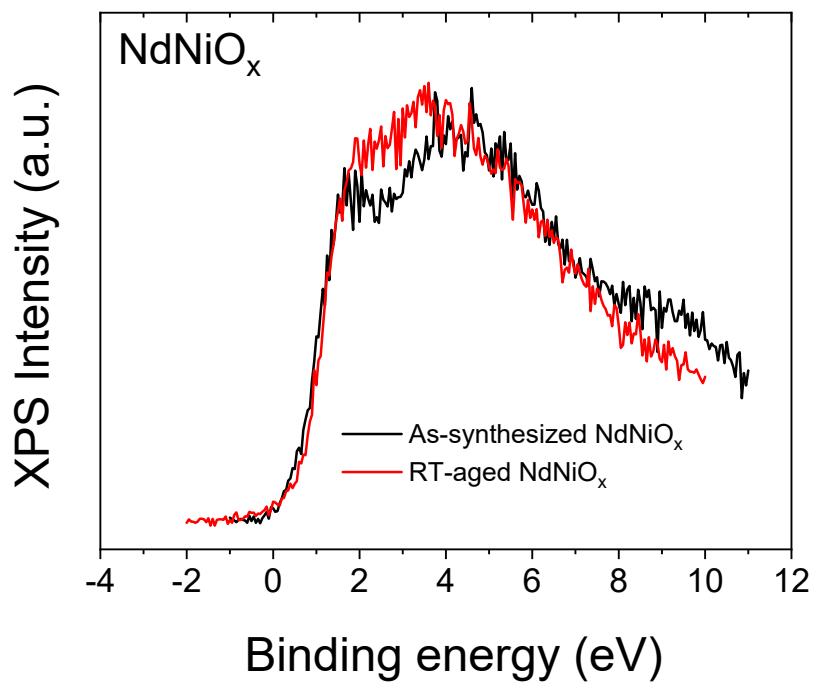


Figure S1. Valence band XPS spectrum of NdNiO_x before and after RT-ageing. In both samples, the VB edge close to the E_F position indicates that both samples are p-type semiconductors.