

Supplementary materials for article

**Kinetics of the binodal decomposition of the metastable Ni<sub>0.5</sub>Ru<sub>0.5</sub> solid solution**

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**S1. Changes in the lattice parameters of the unit cell of the Ni<sub>0.5</sub>Ru<sub>0.5</sub> solid solution upon heating (10 K min<sup>-1</sup>) obtained by the Rietveld refinement.**

Temperature, °C	Time, min	<i>a</i> , Å	<i>c</i> , Å	<i>V</i> , Å <sup>3</sup>
25	0	2.613	4.199	24.8
50	27	2.613	4.200	24.8
100	48	2.614	4.202	24.9
150	70	2.615	4.204	24.9
200	92	2.616	4.206	24.9
250	114	2.617	4.208	25.0
300	136	2.618	4.210	25.0
350	158	2.619	4.211	25.0
400	180	2.619	4.213	25.0
450	202	2.621	4.217	25.1
500	224	2.623	4.219	25.1
* 533	246	2.625	4.222	25.2

Standard deviations of the lattice parameters are ±0.002 Å for *a*, ±0.004 Å for *c* and ±0.1 Å<sup>3</sup> for *V*.

\* At this temperature the sample is three-phase.

**S2. The diffraction data of the Ni<sub>0.5</sub>Ru<sub>0.5</sub> solid solution and decomposition products at 400 °C obtained by the Rietveld refinement.**

Time, min	Ni <sub>0.5</sub> Ru <sub>0.5</sub>				«Ru»				«Ni»		
	<i>a</i> , Å	<i>c</i> , Å	<i>V</i> , Å <sup>3</sup>	<i>I</i> <sub>101</sub>	<i>a</i> , Å	<i>c</i> , Å	<i>V</i> , Å <sup>3</sup>	<i>I</i> <sub>101</sub>	<i>a</i> , Å	<i>V</i> , Å <sup>3</sup>	<i>I</i> <sub>111</sub>
10	2.620	4.212	25.0	5715	-	-	-	-	-	-	-
20	2.620	4.212	25.0	5708	-	-	-	-	-	-	-
30	2.620	4.212	25.0	5708	-	-	-	-	-	-	-
40	2.620	4.212	25.0	5708	-	-	-	-	-	-	-
50	2.620	4.212	25.0	5708	-	-	-	-	-	-	-
60	2.620	4.212	25.0	5708	-	-	-	-	-	-	-
70	2.620	4.212	25.0	5708	-	-	-	-	-	-	-
80	2.620	4.212	25.0	5708	-	-	-	-	-	-	-
90	2.620	4.212	25.0	5708	-	-	-	-	-	-	-
100	2.620	4.212	25.0	5708	-	-	-	-	-	-	-
110	2.620	4.212	25.0	5708	-	-	-	-	-	-	-
120	2.620	4.212	25.0	5708	-	-	-	-	-	-	-
130	2.620	4.212	25.0	5708	-	-	-	-	-	-	-
140	2.620	4.212	25.0	5708	-	-	-	-	-	-	-
150	2.620	4.212	25.0	5708	-	-	-	-	-	-	-
160	2.620	4.212	25.0	5708	-	-	-	-	-	-	-
170	2.620	4.212	25.0	5708	-	-	-	-	-	-	-
180	2.620	4.212	25.0	5708	-	-	-	-	-	-	-
190	2.620	4.212	25.0	5708	-	-	-	-	-	-	-
200	2.620	4.212	25.0	5708	-	-	-	-	-	-	-
210	2.620	4.212	25.0	5708	-	-	-	-	-	-	-
220	2.620	4.212	25.0	5708	-	-	-	-	-	-	-
230	2.620	4.212	25.0	5708	-	-	-	-	-	-	-
240	2.620	4.212	25.0	5708	-	-	-	-	-	-	-
250	2.620	4.212	25.0	5708	-	-	-	-	-	-	-
260	2.620	4.212	25.0	5708	-	-	-	-	-	-	-
270	2.620	4.212	25.0	5708	-	-	-	-	-	-	-
RT	2.620	4.212	25.0	5708	-	-	-	-	-	-	-

Standard deviations of the lattice parameters are  $\pm 0.002$  Å for *a*,  $\pm 0.004$  Å for *c* and  $\pm 0.1$  Å<sup>3</sup> for *V*.

**S3. The diffraction data of the Ni<sub>0.5</sub>Ru<sub>0.5</sub> solid solution and decomposition products at 500 °C obtained by the Rietveld refinement.**

Time, min	Ni <sub>0.5</sub> Ru <sub>0.5</sub>				«Ru»				«Ni»		
	<i>a</i> , Å	<i>c</i> , Å	<i>V</i> , Å <sup>3</sup>	<i>I</i> <sub>101</sub>	<i>a</i> , Å	<i>c</i> , Å	<i>V</i> , Å <sup>3</sup>	<i>I</i> <sub>101</sub>	<i>a</i> , Å	<i>V</i> , Å <sup>3</sup>	<i>I</i> <sub>111</sub>
10	2.623	4.219	25.1	2483	-	-	-	-	-	-	-
20	2.623	4.219	25.1	2460	-	-	-	-	-	-	-
30	2.623	4.219	25.1	2361	2.666	4.238	26.1	20	3.552	44.8	100
40	2.623	4.219	25.1	2302	2.666	4.238	26.1	79	3.551	44.8	196
50	2.623	4.219	25.1	2303	2.666	4.238	26.1	212	3.551	44.8	204
60	2.623	4.219	25.1	2307	2.666	4.238	26.1	223	3.555	44.9	260
70	2.623	4.219	25.1	2280	2.666	4.238	26.1	232	3.555	44.9	457
80	2.623	4.219	25.1	2216	2.666	4.238	26.1	239	3.556	45.0	459
90	2.623	4.220	25.1	2164	2.666	4.238	26.1	285	3.553	44.9	501
100	2.623	4.219	25.1	2129	2.666	4.238	26.1	287	3.555	44.9	523
110	2.623	4.219	25.1	2115	2.666	4.238	26.1	332	3.553	44.9	529
120	2.623	4.219	25.1	2059	2.666	4.238	26.1	390	3.556	45.0	536
RT	2.620	4.215	25.1	2059	2.667	4.246	26.2	390	3.540	44.4	536

Standard deviations of the Ni<sub>0.5</sub>Ru<sub>0.5</sub> and «Ru» lattice parameters are ±0.002 Å for *a*, ±0.004 Å for *c* and ±0.1 Å<sup>3</sup> for *V*.

Standard deviations of the «Ni» lattice parameters are and ±0.003 Å for *a* and ±0.1 Å<sup>3</sup> for *V*.

In accordance with Retgers' rule, "Ru" is a solid solution of the composition Ni<sub>0.20</sub>Ru<sub>0.80</sub> and «Ni» is a solid solution of the composition Ni<sub>0.05</sub>Ru<sub>0.95</sub> at room temperature (RT).

**S4. The diffraction data of the Ni<sub>0.5</sub>Ru<sub>0.5</sub> solid solution and decomposition products at 533 °C obtained by the Rietveld refinement.**

Time, min	Ni <sub>0.5</sub> Ru <sub>0.5</sub>				«Ru»				«Ni»		
	<i>a</i> , Å	<i>c</i> , Å	<i>V</i> , Å <sup>3</sup>	<i>I</i> <sub>101</sub>	<i>a</i> , Å	<i>c</i> , Å	<i>V</i> , Å <sup>3</sup>	<i>I</i> <sub>101</sub>	<i>a</i> , Å	<i>V</i> , Å <sup>3</sup>	<i>I</i> <sub>111</sub>
10	2.623	4.221	25.2	2095	2.666	4.248	26.1	457	3.557	45.0	508
20	2.624	4.221	25.2	1883	2.666	4.248	26.1	645	3.557	45.0	540
30	2.624	4.221	25.2	1776	2.665	4.248	26.1	760	3.556	45.0	577
40	2.624	4.221	25.2	1661	2.666	4.250	26.2	844	3.558	45.0	594
50	2.624	4.222	25.2	1534	2.666	4.251	26.2	953	3.558	45.0	599
60	2.623	4.222	25.2	1467	2.666	4.252	26.2	1103	3.557	45.0	640
70	2.624	4.222	25.2	1401	2.666	4.252	26.2	1144	3.556	45.0	643
80	2.623	4.222	25.2	1279	2.666	4.252	26.2	1254	3.557	45.0	646
90	2.623	4.224	25.2	1223	2.666	4.251	26.2	1300	3.556	45.0	651
100	2.624	4.223	25.2	1195	2.667	4.253	26.2	1430	3.556	45.0	660
110	2.624	4.224	25.2	1096	2.667	4.253	26.2	1449	3.556	45.0	665
120	2.623	4.226	25.2	1001	2.667	4.254	26.2	1495	3.556	45.0	668
130	2.621	4.240	25.2	936	2.667	4.255	26.2	1645	3.556	45.0	674
140	2.620	4.247	25.2	868	2.667	4.252	26.2	1667	3.556	45.0	704
150	2.620	4.247	25.2	806	2.668	4.253	26.2	1748	3.556	45.0	710
160	2.619	4.247	25.2	790	2.668	4.254	26.2	1802	3.555	44.9	715
170	2.619	4.247	25.2	857	2.668	4.254	26.2	1857	3.556	45.0	741
180	2.618	4.251	25.2	735	2.669	4.253	26.2	1871	3.556	45.0	759
190	2.619	4.250	25.2	719	2.668	4.254	26.2	1879	3.555	44.9	796
200	2.619	4.249	25.2	640	2.668	4.255	26.2	1915	3.555	44.9	812
210	2.619	4.251	25.3	613	2.669	4.255	26.2	1990	3.554	44.9	815
220	2.618	4.251	25.2	600	2.669	4.254	26.2	2039	3.555	44.9	816
230	2.618	4.252	25.2	551	2.669	4.255	26.2	2044	3.555	44.9	830
240	2.618	4.253	25.2	529	2.669	4.255	26.2	2046	3.555	44.9	866
250	2.618	4.252	25.2	450	2.669	4.255	26.2	2069	3.555	44.9	944
260	2.618	4.252	25.2	450	2.669	4.255	26.2	2069	3.555	44.9	944
RT	2.620	4.215	25.1	450	2.667	4.246	26.2	2069	3.540	44.4	944

Standard deviations of the Ni<sub>0.5</sub>Ru<sub>0.5</sub> and «Ru» lattice parameters are ±0.002 Å for *a*, ±0.004 Å for *c* and ±0.1 Å<sup>3</sup> for *V*.

Standard deviations of the «Ni» lattice parameters are and ±0.003 Å for *a* and ±0.1 Å<sup>3</sup> for *V*.

In accordance with Retgers' rule, "Ru" is a solid solution of the composition Ni<sub>0.20</sub>Ru<sub>0.80</sub> and «Ni» is a solid solution of the composition Ni<sub>0.05</sub>Ru<sub>0.95</sub> at room temperature (RT).

**S5. The diffraction data of the Ni<sub>0.5</sub>Ru<sub>0.5</sub> solid solution and decomposition products at 566 °C obtained by the Rietveld refinement.**

Time, min	Ni <sub>0.5</sub> Ru <sub>0.5</sub>				«Ru»				«Ni»		
	<i>a</i> , Å	<i>c</i> , Å	<i>V</i> , Å <sup>3</sup>	<i>I</i> <sub>101</sub>	<i>a</i> , Å	<i>c</i> , Å	<i>V</i> , Å <sup>3</sup>	<i>I</i> <sub>101</sub>	<i>a</i> , Å	<i>V</i> , Å <sup>3</sup>	<i>I</i> <sub>111</sub>
10	2.624	4.221	25.2	1883	2.666	4.248	26.1	645	3.557	45.0	540
20	2.624	4.221	25.2	1776	2.665	4.248	26.1	760	3.556	45.0	577
30	2.624	4.221	25.2	1661	2.666	4.250	26.2	844	3.558	45.0	594
40	2.624	4.222	25.2	1534	2.666	4.251	26.2	953	3.558	45.0	599
50	2.623	4.222	25.2	1467	2.666	4.252	26.2	1103	3.557	45.0	640
60	2.624	4.222	25.2	1401	2.666	4.252	26.2	1144	3.556	45.0	643
70	2.623	4.222	25.2	1279	2.666	4.252	26.2	1254	3.557	45.0	646
80	2.623	4.224	25.2	1223	2.666	4.251	26.2	1300	3.556	45.0	651
90	2.624	4.223	25.2	1195	2.667	4.253	26.2	1430	3.556	45.0	660
100	2.624	4.224	25.2	1096	2.667	4.253	26.2	1449	3.556	45.0	665
110	2.623	4.226	25.2	1001	2.667	4.254	26.2	1495	3.556	45.0	668
120	2.621	4.240	25.2	936	2.667	4.255	26.2	1645	3.556	45.0	674
130	2.620	4.247	25.2	868	2.667	4.252	26.2	1667	3.556	45.0	704
140	2.620	4.247	25.2	806	2.668	4.253	26.2	1748	3.556	45.0	710
150	2.619	4.247	25.2	790	2.668	4.254	26.2	1802	3.555	44.9	715
160	2.619	4.247	25.2	857	2.668	4.254	26.2	1857	3.556	45.0	741
170	2.618	4.251	25.2	735	2.669	4.253	26.2	1871	3.556	45.0	759
180	2.619	4.250	25.2	719	2.668	4.254	26.2	1879	3.555	44.9	796
RT	2.623	4.215	25.1	450	2.671	4.253	26.3	2069	3.546	44.6	944

Standard deviations of the Ni<sub>0.5</sub>Ru<sub>0.5</sub> and «Ru» lattice parameters are ±0.002 Å for *a*, ±0.004 Å for *c* and ±0.1 Å<sup>3</sup> for *V*.

Standard deviations of the «Ni» lattice parameters are and ±0.003 Å for *a* and ±0.1 Å<sup>3</sup> for *V*.

In accordance with Retgers' rule, "Ru" is a solid solution of the composition Ni<sub>0.20</sub>Ru<sub>0.80</sub> and «Ni» is a solid solution of the composition Ni<sub>0.05</sub>Ru<sub>0.95</sub> at room temperature (RT).

**S6. The diffraction data of the Ni<sub>0.5</sub>Ru<sub>0.5</sub> solid solution and decomposition products at 600 °C obtained by the Rietveld refinement.**

Time, min	Ni <sub>0.5</sub> Ru <sub>0.5</sub>				«Ru»				«Ni»		
	<i>a</i> , Å	<i>c</i> , Å	<i>V</i> , Å <sup>3</sup>	<i>I</i> <sub>101</sub>	<i>a</i> , Å	<i>c</i> , Å	<i>V</i> , Å <sup>3</sup>	<i>I</i> <sub>101</sub>	<i>a</i> , Å	<i>V</i> , Å <sup>3</sup>	<i>I</i> <sub>111</sub>
10	2.623	4.215	25.1	4194	2.698	4.308	27.2	1650	3.567	45.4	1113
20	2.623	4.220	25.1	2920	2.655	4.269	26.1	2515	3.555	44.9	1535
30	2.623	4.220	25.1	1665	2.664	4.252	26.1	2570	3.555	44.9	1633
40	2.623	4.220	25.1	1313	2.666	4.254	26.2	2751	3.555	44.9	1744
50	2.622	4.246	25.3	1159	2.667	4.255	26.2	2816	3.555	44.9	1843
60	2.635	4.251	25.6	1021	2.670	4.257	26.3	2833	3.555	44.9	1883
70	2.635	4.253	25.6	940	2.670	4.258	26.3	2993	3.555	44.9	1995
80	2.635	4.253	25.6	923	2.672	4.259	26.3	2923	3.555	44.9	2019
90	2.635	4.253	25.6	854	2.672	4.260	26.4	3053	3.555	44.9	2098
100	2.635	4.253	25.6	820	2.674	4.260	26.4	3164	3.555	44.9	2134
110	2.635	4.253	25.6	756	2.675	4.261	26.4	3304	3.556	45.0	2315
120	2.635	4.253	25.6	742	2.675	4.263	26.4	3325	3.556	45.0	2327
130	2.635	4.253	25.6	732	2.676	4.263	26.4	3341	3.556	45.0	2334
RT	2.623	4.215	25.1	732	2.671	4.253	26.3	3341	3.546	44.6	2334

Standard deviations of the Ni<sub>0.5</sub>Ru<sub>0.5</sub> and «Ru» lattice parameters are ±0.002 Å for *a*, ±0.004 Å for *c* and ±0.1 Å<sup>3</sup> for *V*.

Standard deviations of the «Ni» lattice parameters are and ±0.003 Å for *a* and ±0.1 Å<sup>3</sup> for *V*.

In accordance with Retgers' rule, "Ru" is a solid solution of the composition Ni<sub>0.20</sub>Ru<sub>0.80</sub> and «Ni» is a solid solution of the composition Ni<sub>0.05</sub>Ru<sub>0.95</sub> at room temperature (RT).

S7. Initial DSC curves of  $\text{Ni}_{0.5}\text{Ru}_{0.5}$  heating with different rate:  $10 \text{ K min}^{-1}$  (green),  $30 \text{ K min}^{-1}$  (blue) and  $50 \text{ K min}^{-1}$  (red).

