

NB-341: Modification of EA-354 (SrTiO₃:Al, upscaled batch) with Rh, Cr oxide cocatalyst (0.05 wt%), fresh solutions of RhCl₃*3H₂O and Cr(NO₃)₃*9H₂O

Date: 2025-11-11

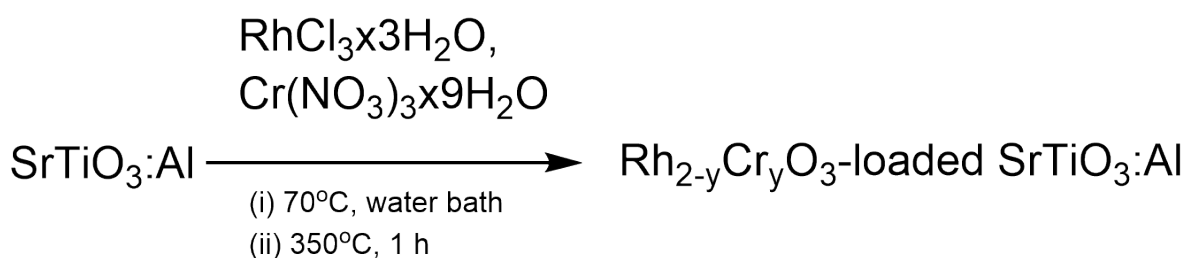
Tags: NB synthesis Furnace Muffle
Furnace SrTiO₃ RhCl₃ Osterloh
RhxCrO₃ Al:SrTiO₃ RhCrO₃:Al:SrTiO₃
Cr(NO₃)₃

Category: SrTiO₃

Status: Done

Created by: Nadzeya Brezhneva

Reaction scheme/sample structure



ChemDraw File (linked): [NB-189-RhCr-oxide-loaded-Al-SrTiO3.cdxml](#)

Literature/reference experiments

Literature	https://doi.org/10.1039/C9EE00310J
Reproduction	/
Similar experiments	SrTiO₃ - NB-321: Modification of EA-354 (SrTiO₃:Al, upscaled batch) with Rh, Cr oxide cocatalyst (0.05 wt%) SrTiO₃ - EA-358: Modification of Al:SrTiO₃ (EA-354) via deposition of Rh, Cr oxide cocatalyst, 350°C, 1h, Upscaling (3.33x) SrTiO₃ - EA-359: Modification of Al:SrTiO₃ (EA-354) via deposition of Rh, Cr oxide cocatalyst, 350°C, 1h

Reagents

Name	CAS Number / Experiment Number	Inventory number	Amount	Equivalents	Mass _{theo} [mg]	Mass _{exp} [mg]	Molar mass [g/mol]	Density [g/ml]	Volume [ul]
Al:SrTiO ₃ (EA-354)	SrTiO₃ - EA-354: Preparation of Al:SrTiO₃ (using EA-352-SrTiO₃-molten-salt and SrCl₂ as flux) at 1000°C, 10 h, Osterloh route, upscaling x15, filtration with PVDF	/	0.81 mmol	1	150	149.51	183.49	/	/
RhCl ₃ solution (9.87 mM in H ₂ O)	Prep work - NB-KRA-340: Preparation of RhCl₃ and Cr(NO₃)₃ stock solutions	/	0.73 umol	0.05 wt% Rh ^[a]	/	75	209.26	/	74
Cr(NO ₃) ₃ solution (28.81 mM in H ₂ O)	Prep work - NB-KRA-340: Preparation of RhCl₃ and Cr(NO₃)₃ stock solutions	/	1.44 umol	0.05 wt% Cr ^[b]	/	50	238.011	/	50

milli-Q water	/	/	0.19 mol	/	/	/	18	0.998	3876 ^[c]
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[a] - Rh content in the final product

[b] - Cr content in the final product

[c] - for suspension preparation

Excel sheet for reagent calculation

[NB-341-calculations.xlsx](#)

Furnace Parameters

Equipment - Muffelofen L3/11/P320, Nabertherm GmbH, Lab 106, CEEC I, (Matilda)

Temperature/time parameters

Used zone or charge sensor	Zone
Used delayed start	/
Used automatic/manual/extended holdback	Automatic
The temperature band entered for manual/extended holdback (°C)	/
End time [min], relative to start of program	/

Segments

	Target Temperature (°C)	Duration (h)	Rate (°C/h)	Temperature band (°C)	Description of the segment	Observations
First segment	350	0:33	600	/	Increase	/
Second segment	350	1:00	/	/	Hold	/
End segment	0	/	/	/	Natural cooling down	/

Procedure/observations

For transfer of precise liquid amount, Eppendorf pipettes were used (for 10 - 100 μ L: 100 μ L Eppendorf, above 100 μ L: 1000 μ L Eppendorf).

Date	Time	Step	Observations	Pictures/Files
11.11.2025	ca. 14:20	Weighing EA-354 , transfer to a 25 mL Schott glass beaker.	Creamy-slightly pinkish solid.	/
	14:30	Placing the glass stirring bar (8 mm) inside the beaker.	/	/
	14:35	Addition of 3876 μ L of H ₂ O (3x1000 + 876) to the beaker.	Creamy, slightly pinkish suspension.	/
	14:36	Placing the beaker with the suspension into the water bath (currently, at room T).	/	/
	14:37	Switching the stirring (400 rpm).	/	/
	14:40	Drop-by-drop addition of 74 μ L of 9.87 mM RhCl ₃ solution to a beaker under stirring.	/	/
	14:41	Drop-by-drop addition of 50 μ L of 28.9 mM Cr(NO ₃) ₃ solution to a beaker under stirring.	/	20251111_144339-after addition of RhCl3 and Cr(NO3)3 solutions.jpg
	14:44	Switching the heating mode on (70 °C, precise mode).	/	
	14:44-16:29	Evaporating of water under constant stirring at 70 °C.	/	

	16:29	Stop stirring, since all water has been evaporated, removing the stirring bar from the beaker.	In general solid seems quite homogeneous	20251111_163059-after evaporation of water.jpg
	17:00-15	Transfer of the solid to the quartz crucible using Smartspatula, covering the crucible with lid and Al foil before further use.	/	20251111_195700-samples in crucibles before calcination -top 0.2 wt% loading bottom 0.05 wt% loading.jpg
	20:00	Loading the crucible with the dried sample in a muffle furnace Equipment - Muffelofen L3/11/P320, Nabertherm GmbH, Lab 106, CEEC I, (Matilda)	/	20251111_200317-samples inside the furnace.jpg
	20:03	Start of the program (350 °C, 1 h, 10 °/min).	/	/
12.11.15	0:30	Removal of the sample from the furnace.	Covering the crucibles with Al foil and storing in the fume hood before further use	/
	15:50	Collecting the sample from the beaker, transfer to a 5 mL vial with a snap cap, weighing. m = 142.14 mg	NB-341-0.05 wt% Rh,Cr-oxide loaded Al:SrTiO₃ Creamy-greyish solid.	20251112_155646-final product.jpg

Product characterization

Sample	Mass [mg]	Purity	Mass _{pure} [mg]	Amount [mol]	Yield [%]	Description	Image	Storage location
NB-341-0.05 wt% Rh,Cr-oxide loaded Al:SrTiO₃	142.14	/	/	/	95.07	Creamy greyish solid.	20251112_155646-final product.jpg	Lab E004 (CEEC II), SSC cabinet

Results

Modification of Al:SrTiO₃ sample (**EA-354**, upscaled batch) with Rh, Cr oxide cocatalyst (0.05 wt% Rh and Cr in final product) was performed. The final product (**NB-341-0.05 wt% Rh,Cr-oxide loaded Al:SrTiO₃**) is represented with creamy-greyish solid, m = 142.14 mg, yield 95.07 %.

Linked experiments

Prep work - [NB-340: Preparation of \$\text{RhCl}_3 \cdot 3\text{H}_2\text{O}\$ and \$\text{Cr}\(\text{NO}_3\)_3 \cdot 9\text{H}_2\text{O}\$ stock solutions](#)

SrTiO₃ - [NB-289: Modification of NB-285 \(SrTiO₃:Al \(from self-made SrTiO₃, Osterloh, no Al₂O₃, PVDF filter\) 1000 C, 10 h\) with Rh, Cr oxide cocatalyst](#)

SrTiO₃ - [NB-301: Modification of NB-285 \(SrTiO₃:Al \(from self-made SrTiO₃, Osterloh, no Al₂O₃, PVDF filter\) 1000 C, 10 h\) with Rh, Cr oxide cocatalyst I](#)

SrTiO₃ - [NB-321: Modification of EA-354 \(SrTiO₃:Al, upscaled batch\) with Rh, Cr oxide cocatalyst \(0.05 wt%\)](#)

Linked resources

Equipment - [Muffelofen L3/11/P320, Nabertherm GmbH, Lab 106, CEEC I, \(Matilda\)](#)

Protocol - [Heat treatment using Muffelofen L3/11/P320, Nabertherm GmbH, Lab 106, CEEC I](#)

Attached files

20251112_155646-final product.jpg

sha256: d63e74fc224815a9977ed551bcf84dd503730b3ad14a788c25c172e8d60f6e7d



NB-341-calculations.xlsx

sha256: 9867c3071e96047440d4edba44e7e10acd0fc2ae6ef70af517902e79e0ef83e4

20251111_200317-samples inside the furnace.jpg

sha256: c98bb38e9e64b141bec82adca182e2da1f5ecbc491268eacd21840a206c5dacd



20251111_195700-samples in crucibles before calcination -top 0.2 wt% loading bottom 0.05 wt% loading.jpg

sha256: 6040d4408319e3b764c1d2c72439667a93b17fc239b3f64af137ef3772fc68ab



20251111_144339-after addition of RhCl_3 and $\text{Cr}(\text{NO}_3)_3$ solutions.jpg

sha256: 44954625f6e7e6f40f09fe5b97f93cc57d89cbd18e546746d76f8564c3f70435



20251111_163059-after evaporation of water.jpg

sha256: 8470612b7a60a46262bbff6809b5f90c66d6d16f8a2b49be11ebaf37c2210af4



Unique eLabID: 20251111-3a7c00efe1be4b78e9568a31f7c73a168b3542f
Link: <https://elab.water-splitting.org/experiments.php?mode=view&id=3421>