

NB-323: Modification of EA-354 (SrTiO₃:Al, upscaled batch) with Rh, Cr oxide cocatalyst (0.2 wt%)

Date: 2025-10-27

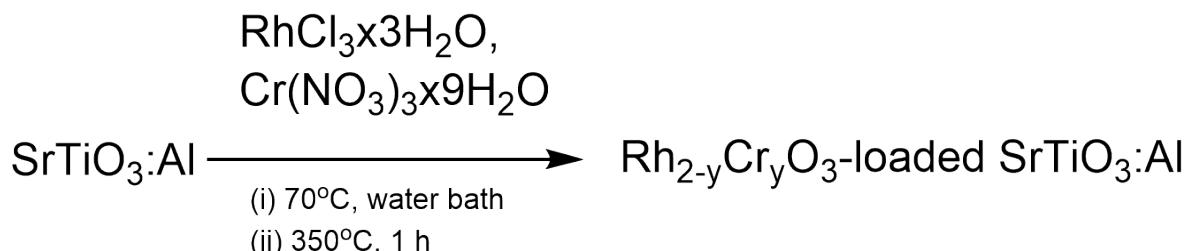
Tags: NB synthesis Furnace Muffle
Furnace SrTiO₃ RhCl₃ Osterloh
RhxCryO₃ Al:SrTiO₃ RhCrO₃:Al:SrTiO₃
Cr(NO₃)₃

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/C9EE00310
Reproduction	/
Similar experiments	SrTiO ₃ - NB-321: Modification of EA-354 (SrTiO ₃ :Al, upscaled batch) with Rh, Cr oxide cocatalyst (0.05 wt%) SrTiO ₃ - EA-358: Modification of Al:SrTiO ₃ (EA-354) via deposition of Rh, Cr oxide co-catalyst, 350°C, 1h, Upscaling (3.33x) SrTiO ₃ - EA-359: Modification of Al:SrTiO ₃ (EA-354) via deposition of Rh, Cr oxide co-catalyst, 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)	SrTiO ₃ - EA-354: Preparation of Al:SrTiO ₃ (using EA-352-SrTiO ₃ -molten-salt and SrCl ₂ as flux) at 1000°C, 10 h, Osterloh route , upscaling x15, filtration with PVDF	/	0.81 mmol	1	150	150.57	183.49	/	/
9.87 mM RhCl ₃ solution (EA-357)	#EA-357	/	2.92 umol	0.2 wt% Rh ^[a]	/	300	209.26	/	300
28.8 mM Cr(NO ₃) ₃ solution (EA-357)	#EA-357	/	5.76 umol	0.2 wt% Cr ^[b]	/	200	238.011	/	200
milli-Q water	/	/	0.19 mol	/	/	/	18	0.998	3500 ^[c]

[a] - Rh content in the final product

[b] - Cr content in the final product

[c] - for suspension preparation

Excel sheet for reagent calculation

[NB-323-calculations.xlsx](#)

Furnace Parameters

Equipment - Muffle furnace Nabertherm LT 15/11/P330 (AWZ 304 lab)

Protocol - Muffle furnace Nabertherm GmbH LT 15/11/P330 (Lab AWZ 304)

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
27.10.2025	21:45	Weighing EA-354 in a 25 mL Schott glass beaker.	Slightly creamy solid.	/
	ca. 22:00	Placing the glass stirring bar (8 mm) inside the beaker.	/	/
	22:30	Addition of 3500 μ L of H ₂ O (3x1000 + 500) to the beaker.	Creamy, slightly pinkish suspension.	/
	ca. 22:35	Placing the beaker with the suspension into the water bath (currently, at room T).	/	20251027_223807-after addition of water.jpg
	22:35	Switching the stirring (400 rpm).	/	/
	22:38	Fast addition of 300 μ L of 9.87 mM RhCl ₃ solution to a beaker under stirring.	/	/
	22:41	Fast addition of 200 μ L of 28.9 mM Cr(NO ₃) ₃ solution to a beaker under stirring.	/	/
	22:45	Switching the heating mode on (70 °C, precise mode).	/	20251027_224515-start of heating.jpg
	22:45-0:24	Evaporating of water under constant stirring at 70 °C.	/	

28.10.2025	0:24	Stop stirring, since all water has been evaporated, removing the stirring bar from the beaker.	A bit more intense pink colour on the edges (walls of the beaker), but in general solid seems quite homogeneous	20251028_002435-after evaporation of water.jpg
	0:30-40	Transfer of the solid to the quartz crucible using Smartspatula, covering the crucible with lid and Al foil before further use.	More intense pink colour than in the case of the sample SrTiO₃ - NB-321: Modification of EA-354 (SrTiO₃:Al, upscaled batch) with Rh, Cr oxide cocatalyst (0.05 wt%) with lower RhCr content	20251028_004253-transferred solid to the crucible before calcination.jpg
	ca. 10:30	Loading the crucible with the dried sample (together with the crucible with the sample SrTiO₃ - NB-321: Modification of EA-354 (SrTiO₃:Al, upscaled batch) with Rh, Cr oxide cocatalyst (0.05 wt%)) in a muffle furnace Equipment - Muffle furnace Nabertherm LT 15/11/P330 (AWZ 304 lab).	/	20251028_103723-before calcination.jpg 20251028_103806-crucibles inside the furnace.jpg
	10:40	Start of the program (350 °C, 1 h, 10 °/min).	/	20251028_104132-start of the calcination program.jpg
	19:20	Removal of the sample from the furnace.	T = 163 °C when opening the lid Grey solid (more intense grey colour in comparison with SrTiO₃ - NB-321: Modification of EA-354 (SrTiO₃:Al, upscaled batch) with Rh, Cr oxide cocatalyst (0.05 wt%)).	20251028_192731-after calcination-top 0.05 wt RhCr-bottom 0.2 wt RhCr.jpg
	20:40	Collecting the sample from the beaker, transfer to a 4 mL vial with a screw cap, weighing. m = 140.76 mg	NB-323-0.2 wt% Rh,Cr-oxide loaded Al:SrTiO₃ Grey solid.	20251028_204029-final product.jpg

Product characterization

Sample	Mass [mg]	Purity	Mass _{pure} [mg]	Amount [mol]	Yield [%]	Description	Image	Storage location
NB-323-0.2 wt% Rh,Cr-oxide loaded Al:SrTiO₃	140.76	/	/	/	93.48	Grey solid.	20251028_204029-final product.jpg	Lab E004 (CEEC II), SSC cabinet (SrTiO ₃ -6 container)

Results

Modification of Al:SrTiO₃ sample (**EA-354**, upscaled batch) with Rh, Cr oxide cocatalyst (0.2 wt% Rh and Cr in final product) was performed. The final product (**NB-323-0.2 wt% Rh,Cr-oxide loaded Al:SrTiO₃**) is represented with grey solid, m = 140.76 mg, yield 93.48 %.

Linked experiments

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

SrTiO₃ - EA-359: Modification of Al:SrTiO₃ (EA-354) via deposition of Rh, Cr oxide co-catalyst, 350°C, 1h

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, \(Matilda\)](#)

Equipment - [Muffle furnace Nabertherm LT 15/11/P330 \(AWZ 304 lab\)](#)

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

Protocol - [Muffle furnace Nabertherm GmbH LT 15/11/P330 \(Lab AWZ 304\)](#)

Attached files

NB-323-calculations.xlsx

sha256: a3c06b7fe2647f19025afeff813b29d410f563300b88bda29938dbb45226e492

20251028_204029-final product.jpg

sha256: be1e0788fb8f5f62b9db8dbcdd31bebb9d06a6701ae4372f44095c6e12dff195



20251028_192731-after calcination-top 0.05 wt RhCr-bottom 0.2 wt RhCr.jpg

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20251028_002435-after evaporation of water.jpg

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20251027_224515-start of heating.jpg

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20251027_223807-after addition of water.jpg

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20251028_103723-before calcination.jpg

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20251028_103806-crucibles inside the furnace.jpg

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20251028_104132-start of the calcination program.jpg

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20251028_004253-transferred solid to the crucible before calcination.jpg

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Unique eLabID: 20251027-2483ba6e778657c8c40727e9a53d8163d203a4e9
Link: <https://elab.water-splitting.org/experiments.php?mode=view&id=3265>