SELECTIVE ELECTROCHEMICAL REDUCTION OF CO_2 TO HIGH VALUE CHEMICALS

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DELIVERABLE REPORT

D9.4 – ORGANIZATION OF A SELECTCO2 DEDICATED SYMPOSIUM		
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Author (s)	Sophia Haussener	
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DISSEMINATION LEVEL		
PU	*Public*	***X***
PP	*Restricted to other programme participants (including the Commission Services)*	
RE	*Restricted to a group specified by the consortium (including the Commission Services)*	
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NATURE OF THE DELIVERABLE		
R	*Report*	***X***
P	*Prototype*	
D	*Demonstrator*	
O	*Other*	

SUMMARY	
Keywords	*Dissemination; Scientific conference*
Abstract	*The consortium (K. Chan - DTU, S. Haussener - EPFL, B. Seger - DTU) organized a dedicated SELECTCO2 symposium (#SOLCAT21: (Photo-)Electrocatalysis: from the atomistic to system scale) at the 2021 NanoGe fall meeting with the aim to i) foster interaction with related ongoing projects at the European level, which address similar targets, and ii) encourage future collaboration and promote exploitation opportunities. This symposium invited contributions on the state of the field in electrochemical reduction of CO_2 and beyond, from the atomistic to the device and industrial scale. Symposium topics spanned fundamental mechanistic studies, catalyst design, operando studies, membranes and ionomers, gas diffusion electrodes, membrane electrode assemblies, flow reactors, device engineering, modelling spanning all relevant length scales, relevant experimental and theoretical methods development, and techno-economic analysis. The conference included talks by 12 invited experts, 17 contributed talks, and a poster session. This event gave visibility to the project results, allowed for knowledge transfer outside the Consortium, encouraged future collaboration and favored exploitation opportunities.*
Public abstract for confidential deliverables	-

REVISIONS			
Version	**Date**	**Changed by**	**Comments**
V1	14/11/2021	S. Haussener	

REPORTS ON DIGITALIZING GDE, ITS STRUCTURAL CHARACTERIZATION AND OPTIMIZATION GUIDANCE

CONTENT

1 PREPARATION OF EVENT

Karen Chan (DTU), Sophia Haussener (EPFL) and Brian Seger (DTU) organized a symposium at the nanoGe Fall Meeting 2021. NanoGe is a prestigious brand of worldwide scientific events that have taken place since 2009. The NFM joins a broad set of materials and device topics in multiple symposia. NFMs have typically more than 600+ attendees. For this broad outreach and the high scientific quality, the organizing committee decided to organize a symposium at NFM. The symposium #SOLCAT21: (Photo-)Electrocatalysis: from the atomistic to system scale) aimed to i) foster interaction with related ongoing projects at the European level, which address similar targets, and ii) encourage future collaboration and promote exploitation opportunities. This symposium invited contributions on the state of the field in electrochemical reduction of CO_2 and beyond, from the atomistic to the device and industrial scale. Symposium topics spanned fundamental mechanistic studies, catalyst design, operando studies, membranes and ionomers, gas diffusion electrodes, membrane electrode assemblies, flow reactors, device engineering, modelling spanning all relevant length scales, relevant experimental and theoretical methods development, and techno-economic analysis.

By December 2, 2020, the organizing committee submitted a proposal for the symposium to nanoGe. By January 13, 2021, the proposal for the @SolCat21 symposium was accepted. By January 15, the agreement between the organizing committee and nanoGe was signed. Originally, the conference was planned to be in Eindhoven, Netherlands, from October 24 to October 29, 2021, but was moved to an online conference from October 18 to October 22, 2021. By mid-February, the invited speakers (Table 1) were approached, their acceptance for presentation confirmed and the list finalized. nanoGe sent official invitations to the speakers by end of May. The speakers were chosen to represent the breath of the field (computational vs. experimental, catalysis vs. device-level etc.) and to represent a gender-balanced (50% invited speakers were female) and location balanced (Europe, Asia, North America, Middle America) specialist field. The deadline for abstract submission was on September 7, followed by the finalization of the conference program by the end of September.

The symposium was announced via the official channels of nanoGe, the SelectCO2 website and the organizers professional network and twitter accounts.

#	Name		Institution	Country
1	Aimy Bazylak	F	University of Toronto	CA
2	Raffaella Buonsanti	F	EPFL	CH
3	Jillian Dempsey	F	University of North Carolina at Chapel Hill	USA
4	Jinlong Gong	M	Tianjin University	PRC
5	Christopher Hahn	M	Lawrence Livermore National Laboratory	USA
6	Yun Jeong Hwang	F	Seoul National University	KR
7	Csaba Janaky	M	University of Szeged	HU
8	Feng Jiao	M	University of Delaware	USA
9	Marc Koper	M	Leiden University	NL
10	Nuria Lopez	F	ICIQ	ES
11	Thomas Schmidt	M	PSI	CH
12	Ana Sofia Varela	F	National Autonomous University of Mexico	MX

Table 1. List of invited speakers

2 EVENT SUMMARY

The program of the symposium is attached in Table A1. The symposium was embedded in the NFM 2021, which in total consisted of 14 scientific and focused symposia and run for 5 days. The #SolCat21 symposium run for 2 full days and included 12 invited talks, 17 contributed talks and multiple posters in the conference-wide poster session. The SelectCO2 consortium provided the chairs for the conference (Karen Chan, Sophia Haussener, Brian

Seger, Thomas Burdyny, Etienne Boutin and Kailun Yang) and contributed with 7 talks (4 from TU Delft and 3 from EPFL). The speakers were introduced with a slide deck acknowledging SelectCO2 (see Figure 1).

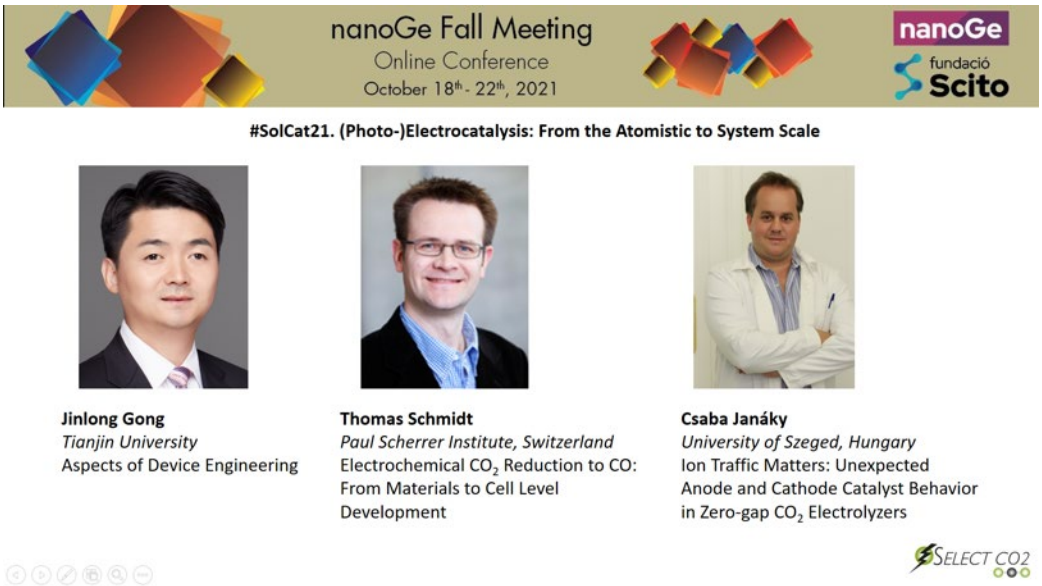
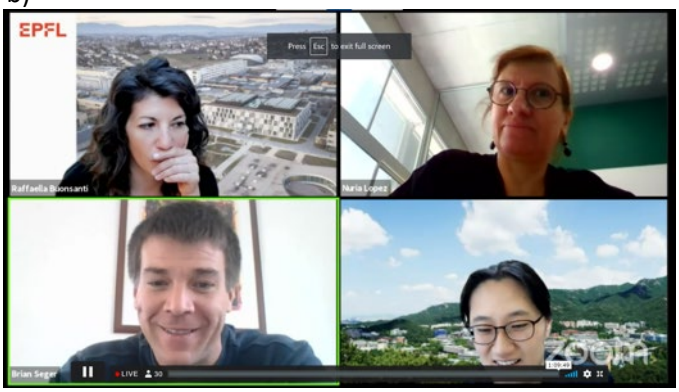


Figure 1. Cover slide introducing the first session of invited speakers.

Some snapshots of the conference are highlighting the conference chairs from SelectCO2 with the invited speakers (Figure 2) and the SelectCO2 members participating in the talks and discussions (Figure 3).

a)

b)



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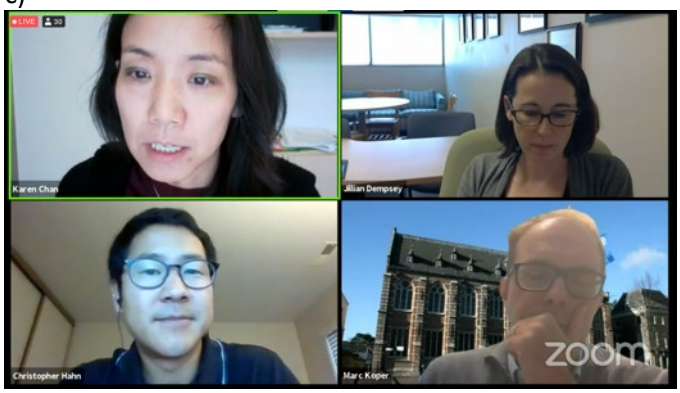
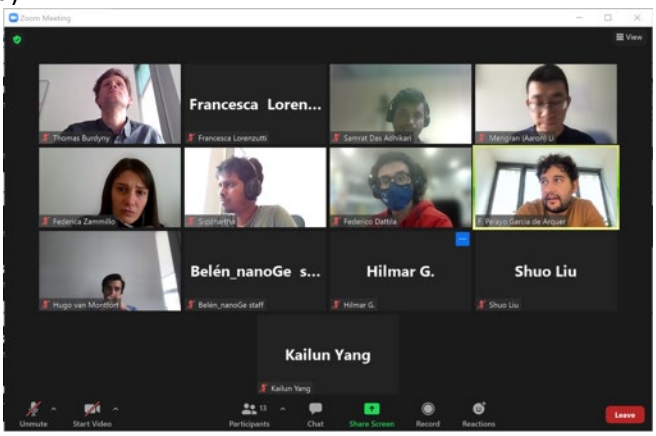


Figure 2. a) Jinlong Gong, Sophia Haussener, Csaba Janaky and Thomas Schmidt (clock-wise, Oct 21); b) Raffaela Buonsanti, Nuri Lopez, Yun Jeong Hwang and Brian Seger (clock-wise, Oct 22), c) Karen Chan, Jillian Dempsey, Marc Koper and Christopher Hahn (clock-wise, Oct 22).

a)



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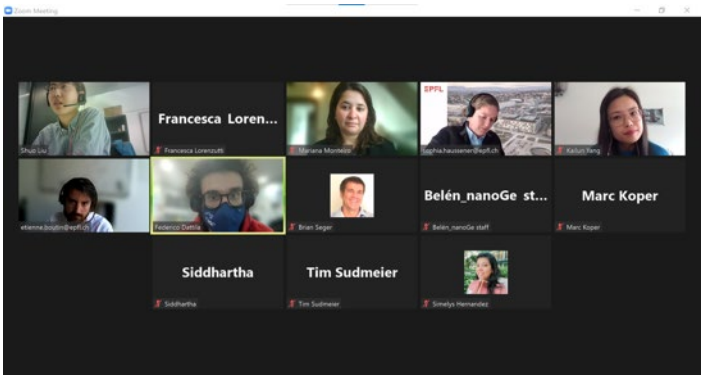

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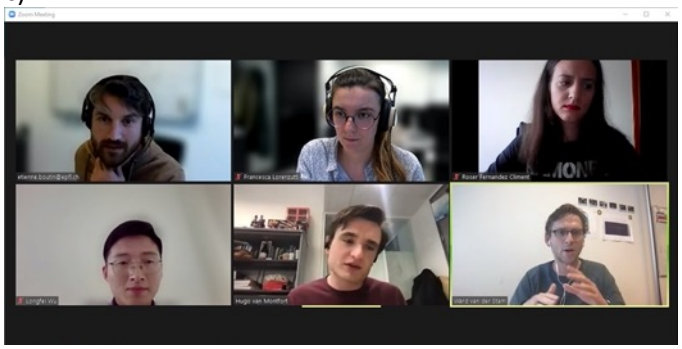

Figure 3. Question and answer sessions for three selected sessions with contributed talks, highlighting participation from SelectCO2 members.

3 CONCLUSIONS AND FUTURE WORK

The #SolCat21 symposium provided an excellent opportunity to disseminate some of SelectCO2's research and outputs. Between ~10 and 20 participants participated in the "question and answer" sessions each time, between ~30 to 60 participants were watching the talks at the scheduled times, and we are expecting that many more saw the talks before (contributed talks were uploaded 1 week in advance of the conference) or after the conference (videos of invited and contributed talks available for 2 additional weeks after the conference). Organizing the symposium in late 2021 will allow the consortium to see the state of the art in the field, only a few months before a Stakeholder Engagement Meeting allowing a clear and sharp discussions with stakeholders on how accelerate this technology the most rapidly

4 ANNEX

#SolCat21. (Photo-)Electrocatalysis: From the Atomistic to System Scale

Thu Oct 21 2021		
10:00 - 10:05		nanoGe Introduction
10:05 - 10:15		Organizer Introduction
		SolCat21 Session 1.1
		Chair: Sophia Haussener
10:15 - 10:35 1.1-I1	**Gong, Jinlong** Tianjin University	Aspects of Device Engineering
10:35 - 10:55 1.1-I2	**Schmidt, Thomas J.** Paul Scherrer Institute	Electrochemical CO2 Reduction to CO: From Materials to Cell Level Development
10:55 - 11:15 1.1-I3	**Janáky, Csaba** University of Szeged	Ion Traffic Matters: Unexpected Anode and Cathode Catalyst Behavior in Zero-gap CO2 Electrolyzers
11:15 - 11:35		Discussion
		SolCat21 Session 1.2
		Chair: Karen Chan
11:35 - 11:45 1.2-T1	**Dattila, Federico** ICIQ Institute of Chemical Research of Catalonia - ICREA, Spain	Modeling Dynamic Processes at the Electrochemical Interface
11:45 - 11:55 1.2-T2	**Boutin, Etienne** Ecole Polytechnique Federale de Lausanne	Modeling CO2 electrochemical reduction kinetics under well-controlled mass-transport conditions
11:55 - 12:05 1.2-T3	**carvajal, david** Universitat Jaume I, Institute of Advanced Materials (INAM) - Spain	Study of the Electrochemical Hydrogenation of Nitrobenzene in Cu and CuPd Electrodes.
12:05 - 12:15 1.2-T4	**Ma, Yinneng** Donghua University	Impact of Photoelectrochemical Alcohol Oxidation Kinetics Upon Selective Formation of Aldehyde on a α-Fe2O3 Surface
12:15 - 12:35		Discussion
12:35 - 14:00		Break
		SolCat21 Session 1.3
		Chair: Etienne Boutin
14:00 - 14:10 1.3-T1	**Fernández Climent, Roser** Universitat Jaume I, Institute of Advanced Materials (INAM) - Spain	Self-blooming, Superstable Copper Sulfide Electrodes for Hydrogen Evolution
14:10 - 14:20 1.3-T2	**Iglesias van Montfort, Hugo-Pieter** Delft University of Technology	Direct imaging of electrocatalytic activity using infrared sensing during water-splitting and CO2 reduction
14:20 - 14:30 1.3-T3	**Lorenzutti, Francesca** Ecole Polytechnique Federale de Lausanne	Pore-level structural characterization of morphologically complex CO2RR electrodes
14:30 - 14:40 1.3-T4	**Wu, Longfei** Utrecht University, The Netherlands	In situ X-ray Diffraction Studies for Electrocatalysis: from Electrode to Single Nanoparticle
14:40 - 15:00		Discussion
15:00 - 15:10		Organizer Introduction
		SolCat21 Session 1.4
		Chair: Brian Seger
15:10 - 15:30 1.4-I1	**Jiao, Feng** University of Delaware	Carbon Dioxide Electrolysis for Sustainable Chemical Production
15:30 - 15:50 1.4-I2	**Bazylak, Aimy** University of Toronto	In operando imaging of carbon dioxide electrolyzers
15:50 - 16:10 1.4-I3	**Varela, Ana Sofia** National Autonomous University of Mexico	CO2 electrochemical reduction on carbon based catalysts
16:10 - 16:30		Discussion
16:30 - 18:30		ePoster Session

Fri Oct 22 2021		
11:00 - 11:10		Organizer Introduction
		SolCat21 Session 2.1
		Chair: Brian Seger
11:10 - 11:30 2.1-I1	**Hwang, Yun Jeong** Seoul National University	Electrocatalyst for CO2 reduction reaction toward stable and practical application
11:30 - 11:50 2.1-I2	**López, Núria** Institute of Chemical Research of Catalonia (ICIQ), Barcelona Institute of Science and Technology (BIST)	Models for interface and advanced CO2 reduction
11:50 - 12:10 2.1-I3	**Buonsanti, Raffaella** Ecole Polytechnique Federale de Lausanne (EPFL)	Shape-controlled nanocrystals to unlock selectivity pathways in the electrochemical CO2 reduction reaction
12:10 - 12:30		Discussion
12:30 - 12:40		Break
		SolCat21 Session 2.2
		Chair: Thomas Burdyny
12:40 - 12:50 2.2-T1	**Li, Mengran** Delft University of Technology, The Netherlands	The vital role of electrode wettability in high-rate carbon dioxide electrochemical reduction
12:50 - 13:00 2.2-T2	**Zanmillo, Federica** Politecnico di Torino, Italy	Optimization of Gas Diffusion Electrode for the Electrochemical CO2 reduction: effect of Nafion content and mass transport issues
13:00 - 13:10 2.2-T3	**Subramanian, Siddhartha** Delft University of Technology	Spatial Reactant Distribution in CO2 Electrolysis- Balancing CO2 Utilization and Faradaic Efficiency
13:10 - 13:30		Discussion
13:30 - 14:00		Break
		SolCat21 Session 2.3
		Chair: Sophia Haussener
14:00 - 14:10 2.3-T1	**Yang, Kailun** Delft University of Technology, The Netherlands	Cation-driven increases in CO2 utilization in a bipolar membrane electrode assembly for CO2 electrolysis
14:10 - 14:20 2.3-T2	**Monteiro, Mariana** Leiden University	The Role of Cations on CO2 Reduction and How Their Properties Impact the Reaction Selectivity
14:20 - 14:30 2.3-T3	**Liu, Shuo** Ecole Polytechnique Federale de Lausanne (EPFL)	Electrical double layer model reveals the possibility of electrochemical CO2 reduction in acidic environment
14:30 - 14:50		Discussion
		SolCat21 Session 2.4
		Chair: Kailun Yang
14:50 - 15:00 2.4-T1	**Yang, Shuang** Utrecht University, The Netherlands	Near unity electrochemical CO2 to CO conversion over Sn-doped CuO nanoparticles with prolonged stability
15:00 - 15:10 2.4-T2	**Guzmán, Hilmar** Politecnico di Torino, Italy	B-doped CuO Catalysts for Enhancing Electroreduction of CO2 to C2+ Products
15:10 - 15:20 2.4-T3	**Hernandez, Simelys** Politecnico di Torino, Italy	Electrochemical CO2 Conversion on metal-oxides-based nanostructures and scale-up challenges
15:20 - 15:40		Discussion
15:40 - 15:50		Organizer Introduction
		SolCat21 Session 2.5
		Chair: Karen Chan
15:50 - 16:10 2.5-I1	**Dempsey, Jillian** University of North Carolina at Chapel Hill, Department of Chemistry	Local Microenvironments at Disordered Interfaces Visualized through Ensemble Measurements
16:10 - 16:30 2.5-I2	**Koper, Marc** Leiden University	Advances and challenges in understanding the electrocatalytic conversion of carbon dioxide to fuels
16:30 - 16:50 2.5-I3	**Hahn, Christopher** Lawrence Livermore National Laboratory	Electrocatalysis for CO2 Reduction: Using Bimetallic Effects to Control Reactivity
16:50 - 17:10		Discussion
17:10 - 17:15		Closing Symposium

TABLE A1. #SOLCAT21 SYMPOSIUM PROGRAM.