

**UNDERSTANDING CHARGE, MASS AND HEAT TRANSFER IN  
FUEL CELLS FOR TRANSPORT APPLICATIONS**

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**Project Coordinator:** Dr. Patrick Fortin - SINTEF

**DELIVERABLE REPORT**

Note: D6.3 was delayed until the end of the project and therefore this deliverable is identical to D6.5. This was communicated with and approved by the project officer.

<b>D6.3 – Dissemination &amp; Communication Bundle</b>		
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<b>DISSEMINATION LEVEL</b>		
<b>PU</b>	Public	<b>X</b>
<b>PP</b>	Restricted to other programme participants (including the Commission Services)	
<b>RE</b>	Restricted to a group specified by the consortium (including the Commission Services)	
<b>CO</b>	Confidential, only for members of the consortium (including the Commission Services)	
<b>NATURE OF THE DELIVERABLE</b>		
<b>R</b>	Report	<b>X</b>
<b>P</b>	Prototype	
<b>D</b>	Demonstrator	
<b>O</b>	Other	

<b>SUMMARY</b>	
<b>Keywords</b>	<i>Dissemination, Exploitation, Communication</i>
<b>Abstract</b>	<p><i>The CAMELOT consortium has been disseminating and communicating about the project outputs throughout its duration. Among those activities, the partners have shared their results during international conferences and workshops, and one full day modelling workshop was organized.</i></p> <p><i>After the end of the project, the consortium will continue to carry out further activities to disseminate and exploit the results.</i></p> <p><i>The protection of intellectual rights of results issued from CAMELOT project will still follow the agreed dissemination protocol, to ensure confidentiality and the legitimate interests of the partners, according to the Grant Agreement article II.30 and the internal dissemination protocol (D6.2).</i></p>
<b>Public abstract for confidential deliverables</b>	<i>Same as above</i>

<b>REVISIONS</b>			
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# SURVEY OF DISSEMINATION ACTIVITIES & FINAL PLAN FOR DISSEMINATION

## AND EXPLOITATION OF PROJECT RESULTS

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## 1 INTRODUCTION

During the CAMELOT project course, the consortium has been disseminating and communicating towards different target groups included industry, academia, government bodies and the public, summarise in the table below.

Type of activity	Actions
Communication activities	<ul style="list-style-type: none"> <li>Website – D6.1</li> <li>Set of identity tools</li> <li>Brochure</li> <li>Newsletters #1 &amp; #2</li> <li>LinkedIn posts</li> <li>Press releases</li> </ul>
Dissemination/ exploitation activities	<ul style="list-style-type: none"> <li>7 conference presentations</li> <li>CAMELOT workshop</li> </ul>
Networking	<ul style="list-style-type: none"> <li>FURTHER-FC workshop on modelling</li> </ul>

All partners intend to continue the dissemination and exploitation of the project results after the end of the project, with respect to the intellectual property rights, confidentiality, and the legitimate interests of each partner according to the Grant Agreement article II.30 and the internal dissemination protocol (D6.2).

## 2 DISSEMINATION & COMMUNICATION ACTIVITIES

### 2.1 Communication activities

#### Design of a project visual identity set and project templates (logo, presentation templates ...)

A CAMELOT logo, as well as specific templates have been made available on the project workplace so each partner can use it for presentations/report related to the project.

#### Project website

The project website (<https://www.camelot-fuelcell.eu>) has been officially released at M4 and provides an overview of the status and the progress of the project. This website is updated on a regular basis and includes the most relevant information like public deliverable reports, publishable summaries of confidential deliverable reports, updates on dissemination activities and other project news, which were communicated to the public and the scientific community. The public website shows more than 1900 visits.

**At the end of the project, the CAMELOT website will reflect the status of the project as finished but nevertheless, it will remain active as an information source of the all-consortium activities linked to the project and will be updated new information like publications, reports and results which will be clearly communicated through relevant news items.**

#### Brochure

A CAMELOT brochure presenting the project and its objectives has been released at month 7. This brochure is available on the project workplace as well as on the project website ([PDF](#)) and has also been circulated among the partners and has been distributed during the Fuel Cell Powertrain at f-cell Stuttgart - Energizing Hydrogen Markets on 29-30 September 2020. Some partners have also shared it on their LinkedIn accounts.

#### Newsletters

- Newsletter issue#1 - February 2021-** The first edition of a CAMELOT newsletter presenting the most relevant results obtained during the first year has been released. It has been made available on the PSW and on the project website ([PDF](#)). This newsletter was spread using partner's LinkedIn account has been seen more than 1600 times.

- **Newsletter issue#2 – August 2023** : This newsletter is available on the PSW, the public website ([PDF](#)) and was spread using partner's LinkedIn account (1560 views)

## Press Releases

### PowerCell SE - January 2022

#### [PowerCell joins European development project on fuel cell technology of the future](#)

To accelerate the company's long-term technological development, PowerCell Sweden AB has joined the coordinated European development project Camelot. The objective of the project is to produce material for fuel cells of the future. Other project participants include leading research institutions, universities, and industrial companies, such as BMW.

### SINTEF BLOG - March 2020

#### [New project to improve the power density of PEM fuel cells](#)

January 1, 2020, was the start date for a new FCH JU funded project coordinated by SINTEF. The project objective is to improve the power density of PEM fuel cells. Through modelling of transport phenomena and advanced characterisation of state-of-art MEA components, performance limiting factors will be identified. By the optimisation of layers and interfaces construction to minimise these limiting factors, disruptive performance increases will be enabled.

***The CAMELOT project will keep on communicating on its main achievements.***

***Soon, the consortium will release the third issue of the newsletter published on the project website and released on LinkedIn.***

## 3 DISSEMINATION ACTIVITIES

### 3.1 Publications

The CAMELOT partners will publish the results obtained during the project. One manuscript is already in preparation:

- Choi, Y.; Platzek, P.; Coole, J.; Fortin, P. The Influence of Membrane Thickness and Catalyst Loading on Performance of Next-Generation Proton Exchange Membrane Fuel Cells. *J. Int. Hydrog. Energy*

### 3.2 Conference Presentations

CAMELOT partners have disseminated project results at conferences through oral and poster presentations including:

- **EU Hydrogen Research Days 2023, 15-16 November 2023, Online Event**  
**Oral Presentation:** CAMELOT – Understanding Charge, Mass, and Heat Transfer in Fuel Cells for Transport Applications, Patrick Fortin, SINTEF
- **244<sup>th</sup> Electrochemical Society Meeting, 8-12 October 2023, Gothenburg, Sweden**  
**Oral Presentation:** Understanding Charge, Mass, and Heat Transfer in Fuel Cells for Transport Applications – Insights from the CAMELOT Project, Patrick Fortin, SINTEF  
**Poster Presentation:** Localized Study of the CCM with Graded Ionomer and Catalyst Loading across the X-Y and Z Directions Using Current Scan Shunt, Yejung Choi, SINTEF
- **European Fuel Cells and Hydrogen Piero Lunghi Conference", 13-15 September 2023, Capri, Italy**  
**Oral presentation:** Understanding Charge, Mass, and Heat Transfer in Fuel Cells for Transport Applications – Insights from the CAMELOT Project, Patrick Fortin, SINTEF
- **242nd Electrochemical Society meeting, 9-13 October 2022, Atlanta, USA**  
**Oral presentation:** Graded Catalyst Layers as a Strategy to Increase Power Density and Reduce Catalyst Loading, Patrick Fortin, SINTEF

- **FURTHER-FC workshop on modelling, July 6, 2022, German Aerospace Center, Stuttgart, Germany**  
**Invited Oral Presentation:** CAMELOT overview, Thor Aarhaug, Sintef
- **Hydrogen Days 2022 – 12th International conference on hydrogen technologies “Hydrogen for Decarbonisation”, 23-25 March 2022, Prague, Czech Republic**  
**Oral Presentation:** SteppinWolf: Pseudo 2D simulation of a single cell based on MMM1D, Jiří Hrdlička (Technical University Chemnitz, Germany)

### 3.3 Conference organisation

#### **CAMELOT workshop on Fuel Cell Modeling, Understanding Charge, Mass, and Heat Transfer in Proton Exchange Membrane Fuel Cells, 6-7 December 2023, Chemnitz University of Technology, Germany**

CAMELOT project is focused on the understanding of the limitations in performance of proton exchange membrane fuel cells to guide the development of the next generation of polymer electrolyte membrane fuel cells.

As part of this work, a free and open-source Fuel Cell Performance Model developed by FAST Simulations UG, FAST-FC, has been utilized, improved and extended to describe the transport and kinetic processes in ultra-thin, low-loaded membrane electrode assemblies.

20 participants from across Europe joined us for an evening of networking, followed by a full day modelling workshop where the participants were provided with an understanding of the general theory behind the model, a summary of the improvements made within the CAMELOT Project, and a hands-on tutorial with instruction on how to use the model provided by the FAST Simulations team.

### 3.4 Exhibitions

#### **European Hydrogen Week 2023, 20-24 November 2023, Brussels, Belgium**

European Hydrogen Week offers to attendees a first-hand view of the latest in electrolyser and fuel cell technologies as well as touch with hand and test hydrogen trucks, buses, and cars. In this context CAMELOT has been showcasing its latest achievements, essentially on the free and open-source Fuel Cell Performance Model developed by FAST Simulations UG, FAST-FC.

#### **Fuel Cell Powertrain at f-cell Stuttgart - Energizing Hydrogen Markets, 29-30 September 2020**

F-cell hosted its 20<sup>th</sup> live event in Stuttgart in September 2020, an industry’s key international networking event for the emerging hydrogen energy sector. This annual event for hydrogen and fuel cell experts provided an extensive overview for relevant international markets and industries as well as technological advancements. After a tough year for in-person business networking events, COVID-19 health measures were adapted to have held a successful 2-day hybrid conference and trade fair. Through a combination of on-site and online access, f-cell 2020 hosted 650 Attendees from around the world, 92 Speakers, 52 Exhibitors, 4 Plenaries, 12 Sessions, 16 f-cell Pitches, an f-cell award ceremony, and a 24-hour Hydrogen Challenge with 17 teams. Fuel Cell Powertrain (FCP) has showcased its 30 kW Fuel Cell Module for mobile applications in the heavy-duty sector integrated in its RED60 Fuel Cell system showing that it is possible using multiple modules to scale to a wide power range addressing a huge variety of applications. FCP also actively promoted the region of Chemnitz, in the State of Saxony, about to become a major center of competence for fuel cell technology and, thus, also leveraged the event to highlight its commitment in the highly innovative FCH-JU funded Project CAMELOT.

### 3.5 Networking

#### **FURTHER-FC workshop on modelling, July 6, 2022, German Aerospace Center, Stuttgart, Germany - [Website](#)**

**Invited Oral Presentation:** Thor Aarhaug

FURTHER-FC is the sister project of CAMELOT: it was funded under the same topic in 2019. On July 6 in Stuttgart at DLR premises, a workshop on fuel cell modelling was hosted by the FURTHER-FC consortium. Coordinator of CAMELOT, Thor Aarhaug was invited to present CAMELOT. Due to covid restrictions, a limit of 50 participants were set. The event was fully booked, and in addition about 50 to 60 participated online. In addition to project

presentations, invited talks from Toyota Motor Europe, Chemours and Hydrogen Europe set the scope of the project in a wider perspective.

The workshop featured high-quality presentations on modelling of fuel cells. Performance challenges like oxygen mass limitations due to ionomer in CCL was discussed in detail, and Chemours presented their new ionomer product with improved oxygen diffusion.

## 4 EXPLOITATION OF THE RESULTS

The market for fuel cell and electrolyser CCMs is foreseen to be worth £2-4bn and £2-10bn respectively by 2030 (IEA, Hydrogen Council, Morgan Stanley) with JM aiming for a 33% share of the addressable market. JM builds on existing CCM manufacturing capacity of 2 GW expanding to 5 GW in 2024. The synergy from this project has clear transferability across multiple applications<sup>1</sup> from PEM fuel cell to electrolyzers. The X-Y-Z digital coating concept is one that is envisaged for JM future process application and a concept that will be pursued further within HIGHLANDER. The JM technology team is being trained with the CAMELOT modelling tools and these have the potential to accelerate technology development going forward.

As a research organization, SINTEF will continue to build on the research results obtained within CAMELOT through continued participation in the Clean Hydrogen Partnership Joint Undertaking, both through participation in future fuel cell projects and through providing input to the strategic direction of fuel cell research within Europe. The experience and results obtained within CAMELOT will be used to shape future Research and Innovation actions aimed at reaching future key performance indicators and ultimately the market uptake of beyond state-of-the-art fuel cell technologies.

## 5 CONCLUSION

WP6 has completed the required tasks and deliverables as described on the Document of Work, except for the number of publications in peer reviewed journals that has not reached the initial target. However, one is already in preparation and will be submitted within the next months.

The partners will continue to ensure dissemination and communication actions depending on the latest results obtained. This will be achieved through:

- An update of the public website: information on published papers, reports and results will be clearly communicated through relevant news items.
- Publications in peer-reviewed journals
- Conference attendances
- 3<sup>rd</sup> issue of the newsletter

Finally, partners will undertake all the necessary measures to exploit the project results, through further research and development activities.

<sup>1</sup> <https://matthey.com/en/news/2021/new-hydrogen-technology-business>

## 6 CAMELOT WORKSHOP PROGRAMME

### Wednesday December 6th, 2023

**18:00 - 21:00** Networking Event

### Thursday December 7th, 2023

**8:30 - 9:00** Welcome & Introduction

*Senen Saez, TU Chemnitz, Germany*

**09:00 - 9:30** General Introduction to CAMELOT

*Patrick Fortin, SINTEF, Norway*

**09:30 - 10:30** General Introduction to FAST-FC

*David Harvey, FAST Simulations UG, Germany*

**10:30 - 10:45** *Mid-Morning Break*

**10:45 - 12:00** Thin Ionomer Model

*Jiri Hrdlicka, FAST Simulations UG, Germany*

**12:00 - 13:00** *Lunch*

**13:00 - 14:00** Application of FAST-FC

*David Harvey, FAST Simulations UG, Germany*  
*Jiri Hrdlicka, FAST Simulations UG, Germany*

**14:00 - 15:30** FAST-FC Tutorials

*David Harvey, FAST Simulations UG, Germany*

**15:30 - 15:45** *Mid-Afternoon Break*

**15:45 - 17:30** Open Application and Q & A Session

*David Harvey, FAST Simulations UG, Germany*  
*Jiri Hrdlicka, FAST Simulations UG, Germany*