



## FERRET

A FLEXIBLE NATURAL GAS MEMBRANE REFORMER FOR M-CHP APPLICATIONS

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### WP2 - Catalyst development and scale-up

#### D2.5

### Public report on the manufacturing of scaled up catalyst

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<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>CON</b>	Confidential, only for members of the Consortium	

(\*) for generating such code please refer to the Quality Management Plan, also to be included in the header of the following pages

(\*\*) indicate the acronym of the partner that prepared the document

  	<p><b>D2.5</b>  <b>Public report on the manufacturing of  scaled up catalyst</b></p>	<p>Proj. Ref.: FERRET-621181  Doc. Ref.: FERRET-WP02-D25-DLR-  JM-19012016-v02.doc  Date: 16/10/2015  Page N°: 2 of 7</p>
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**Content**

**1. EXECUTIVE SUMMARY (3 pages max. all points)..... 3**

    1.1. Description of the deliverable content and purpose ..... 3

    1.2. Brief description of the state of the art and the innovation brought ..... 3

    1.3. Deviation from objectives ..... 3

**2. INTRODUCTION..... 4**

**3. PREPARATION OF THE CATALYST..... 5**

    3.1. Lab Scale ..... 5

    3.2. Production Scale..... 5

    3.3. Sieving..... 5

**4 CATALYST BATCH TESTING..... 6**

**5 CONCLUSIONS..... 7**

  	<b>D2.5</b> <b>Public report on the manufacturing of scaled up catalyst</b>	Proj. Ref.: FERRET-621181 Doc. Ref.: FERRET-WP02-D25-DLR-JM-19012016-v02.doc Date: 16/10/2015 Page N°: 3 of 7
-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------

## 1. EXECUTIVE SUMMARY (3 pages max. all points)

### 1.1. Description of the deliverable content and purpose

WP2 is focused on the development of a fluidizable autothermal reforming catalyst that can achieve the necessary activity to allow the FERRET CHP system to produce the target of 5Nm<sup>3</sup>/h of hydrogen. The catalyst also has to exhibit stability up to a potential of 3000 hours of operation.

The deliverable explains Johnson Matthey's scale up of the FERRET catalyst from a lab scale to a product to fill the FERRET reactor.

### 1.2. Brief description of the state of the art and the innovation brought

The FERRET catalyst development activities have resulted in a scalable catalyst that exhibits superior activity and stability in comparison to previous Johnson Matthey materials and can function within a fluidized bed system with minimal degradation.

Previous Johnson Matthey reforming catalysts were not fluidizable.

### 1.3. Deviation from objectives

None




  	<b>D2.5</b> <b>Public report on the manufacturing of scaled up catalyst</b>	Proj. Ref.: FERRET-621181 Doc. Ref.: FERRET-WP02-D25-DLR-JM-19012016-v02.doc Date: 16/10/2015 Page N°: 4 of 7
-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------

## 2. INTRODUCTION

The aim of the FERRET project is to create a flexible fuel cell CHP system that utilises autothermal reforming (ATR) of natural gas to generate clean hydrogen in a fluidized bed membrane reactor. The system is designed to cope with the variable natural gas compositions from across the EU and produce 5Nm<sup>3</sup>/h of hydrogen.

The partner responsible for producing a catalyst that is active under the required conditions but is also stable to the life time of the system is Johnson Matthey.

The catalyst has been scaled up from a lab scale preparation of ~10g to a production scale and 3.5kgs has been made for the project.

  	<b>D2.5</b> <b>Public report on the manufacturing of scaled up catalyst</b>	Proj. Ref.: FERRET-621181 Doc. Ref.: FERRET-WP02-D25-DLR-JM-19012016-v02.doc Date: 16/10/2015 Page N°: 5 of 7
-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------

### **3. PREPARATION OF THE CATALYST**

#### **3.1. Lab Scale**

The catalyst was prepared on a 10g lab scale. This preparation was used to test catalysts for activity and stability to the FERRET conditions.

The catalyst was prepared by wet impregnation before drying and calcining to formulate the final catalyst.




#### **3.2. Production Scale**

The catalyst was produced in 600-800g batches. This preparation was used to formulate the final catalyst for the FERRET system.

The catalyst was prepared by wet impregnation before drying and calcining to formulate the final catalyst.




#### **3.3. Sieving**

Due to recalculations, the catalyst was re-sieved in order to remove the fines from the catalyst powder. The sieving fractions were raised to better accommodate the FERRET reactor's specifications.

  	<p style="text-align: center;"><b>D2.5</b> <b>Public report on the manufacturing of scaled up catalyst</b></p>	<p>Proj. Ref.: FERRET-621181 Doc. Ref.: FERRET-WP02-D25-DLR- JM-19012016-v02.doc Date: 16/10/2015 Page N°: 6 of 7</p>
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#### **4 CATALYST BATCH TESTING**

Catalyst batches were tested individually to ensure consistency. They were tested across a range of temperatures to mirror testing in the FERRET project and showed identical activity across all of the temperatures investigated. The reliability across the different batches shows that the catalyst can be successfully scaled up from lab testing..

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## 5 CONCLUSIONS

Catalyst scale up was completed with 3kgs of catalyst delivered to Hygear for the FERRET reformer unit and 500g of blank alumina material. The alumina material has been tested at TUE to ensure there is no interaction between it and the membrane.

The catalyst batches have been tested and compared with the lab scale catalyst preparation to ensure there are no performance differences when the catalyst is scaled up. There is consistency between each of the batches as well as the lab scale catalyst confirming that the catalyst has been successfully scaled up.