

DEVELOPMENT OF CARBON MOLECULAR SIEVE MEMBRANES FOR THE USE OF RENEWABLE GASES, BIOMETHANE AND HYDROGEN IN NATURAL GAS NETWORKS

A.M. Gutierrez¹, J.R. Arraibi¹, M.A. Llosa Tanco², J. Zúñiga², J.L. Viviente², L. García Gómez³

Paper:

IBP0739_17

¹ EDP Naturgas Energía, General Concha 20, 48010 Bilbao, Spain

² TECNALIA, Materials for Energy & Environment Department, Mikeletegi Pasealekua, 2, 20009 Donostia-San Sebastian, Spain

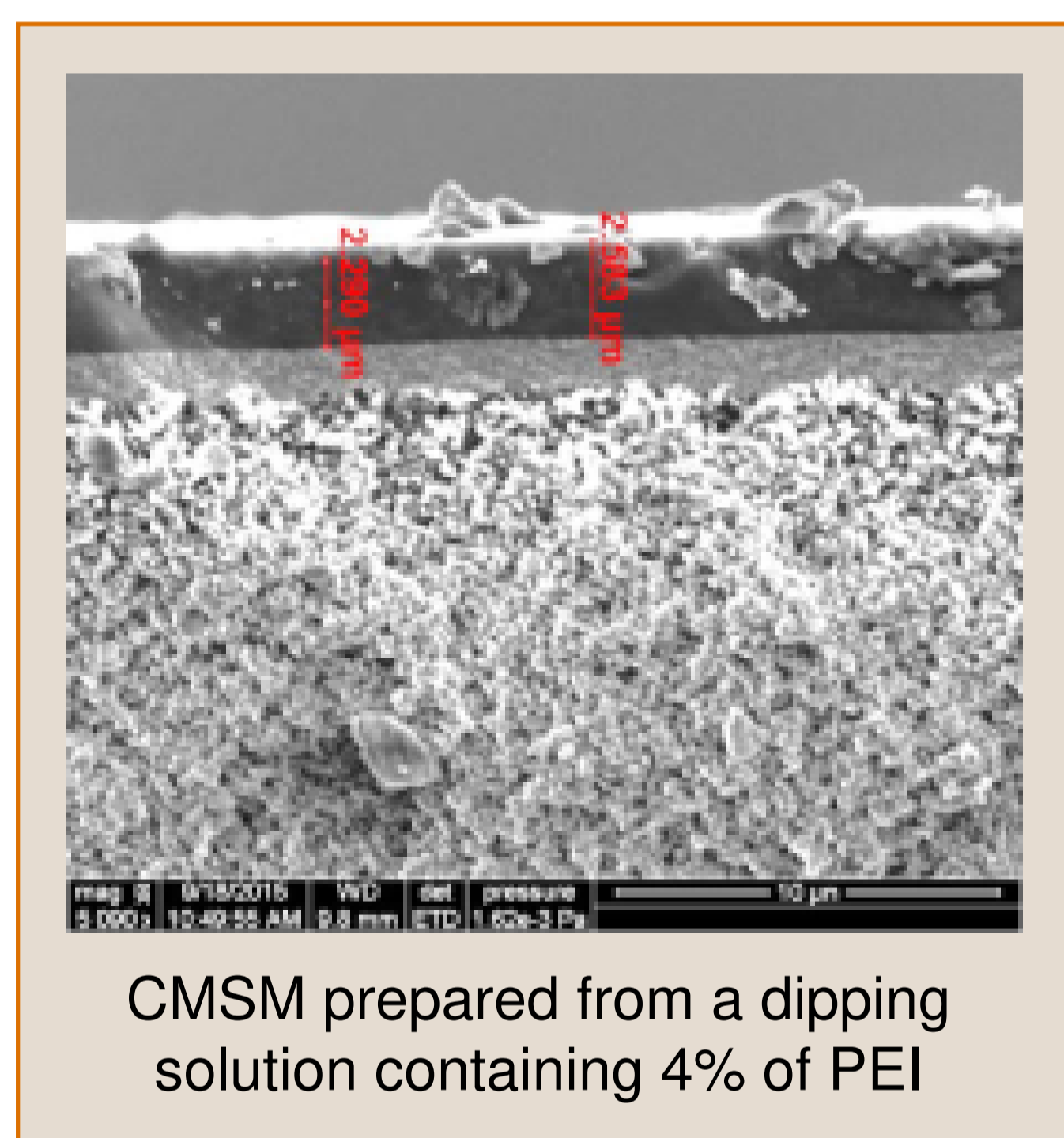
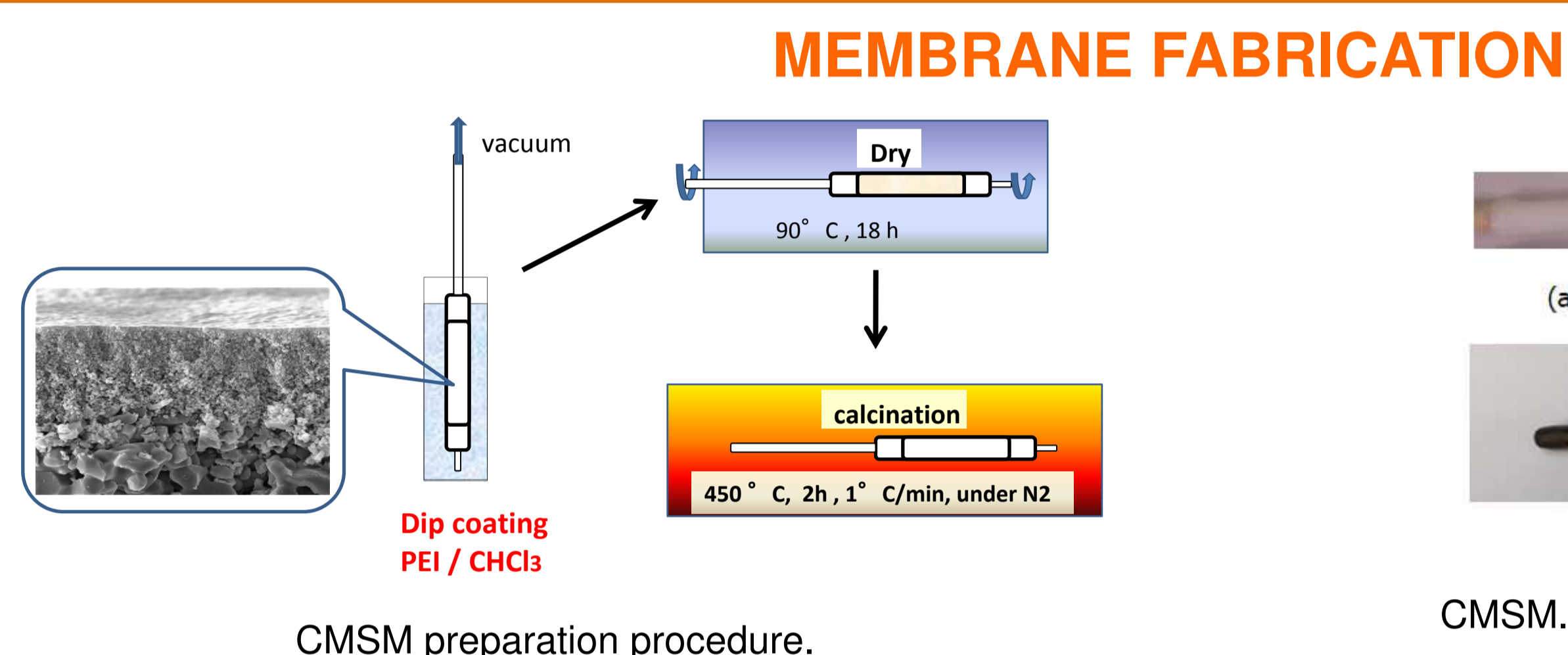
³ iCUBE, C/ Jimena Fernández de la Vega 140 Of.1E, Parque Científico y Tecnológico, 33203 - Gijón (Spain)

Introduction

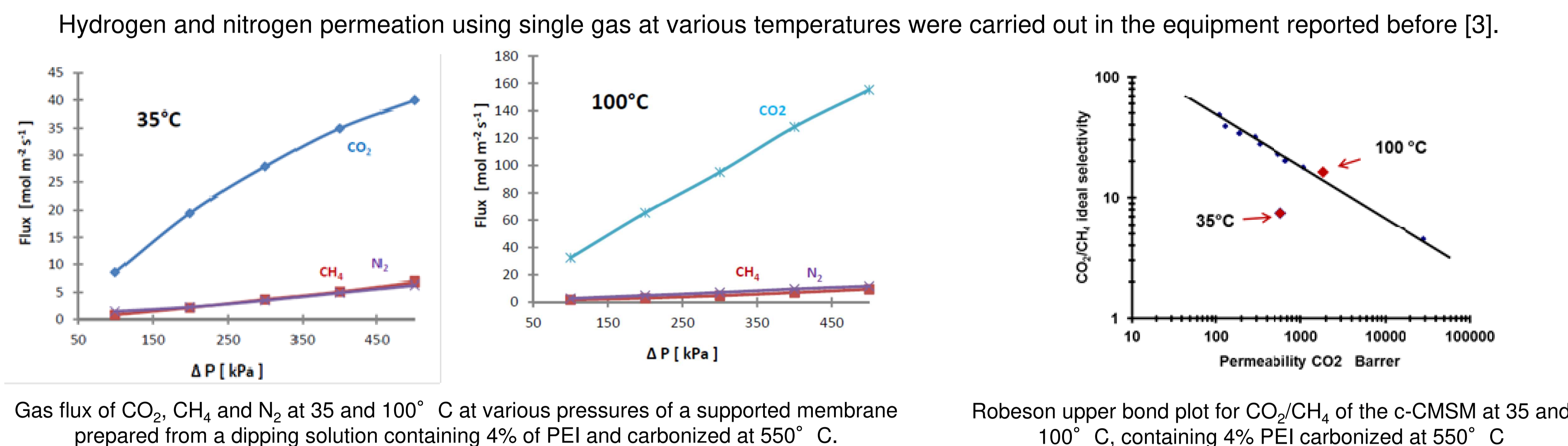
The European Union is fostering cleaner energy to make the EU a global leader in renewable energy and ensure that the target of at least 27% of renewables in the final energy consumption in the EU by 2030 is met. In this sense, the renewable gases such as biogas and hydrogen can play an important role to make the natural gas networks greener. In this sense Naturgas Energía has been collaborating with Tecnalia on the development of membranes that can surpass the current limitations today present, more precisely, the application of CMSM in the projects BioHysis (Hybrid and flexible system for biogas upgrading for injection in natural gas grid) and HyGrid (Flexible hybrid separation system for H₂ recovery from natural gas grid).

The BioHysis project for biogas upgrading

The BioHysis project proposes an integral solution for developing of an advanced high performance, cost effective separation technology biogas upgrading for its later injection in the natural gas network. For this purpose, novel CMSM membranes based on commercial polymers where developed showing better performance than state of the art membranes.

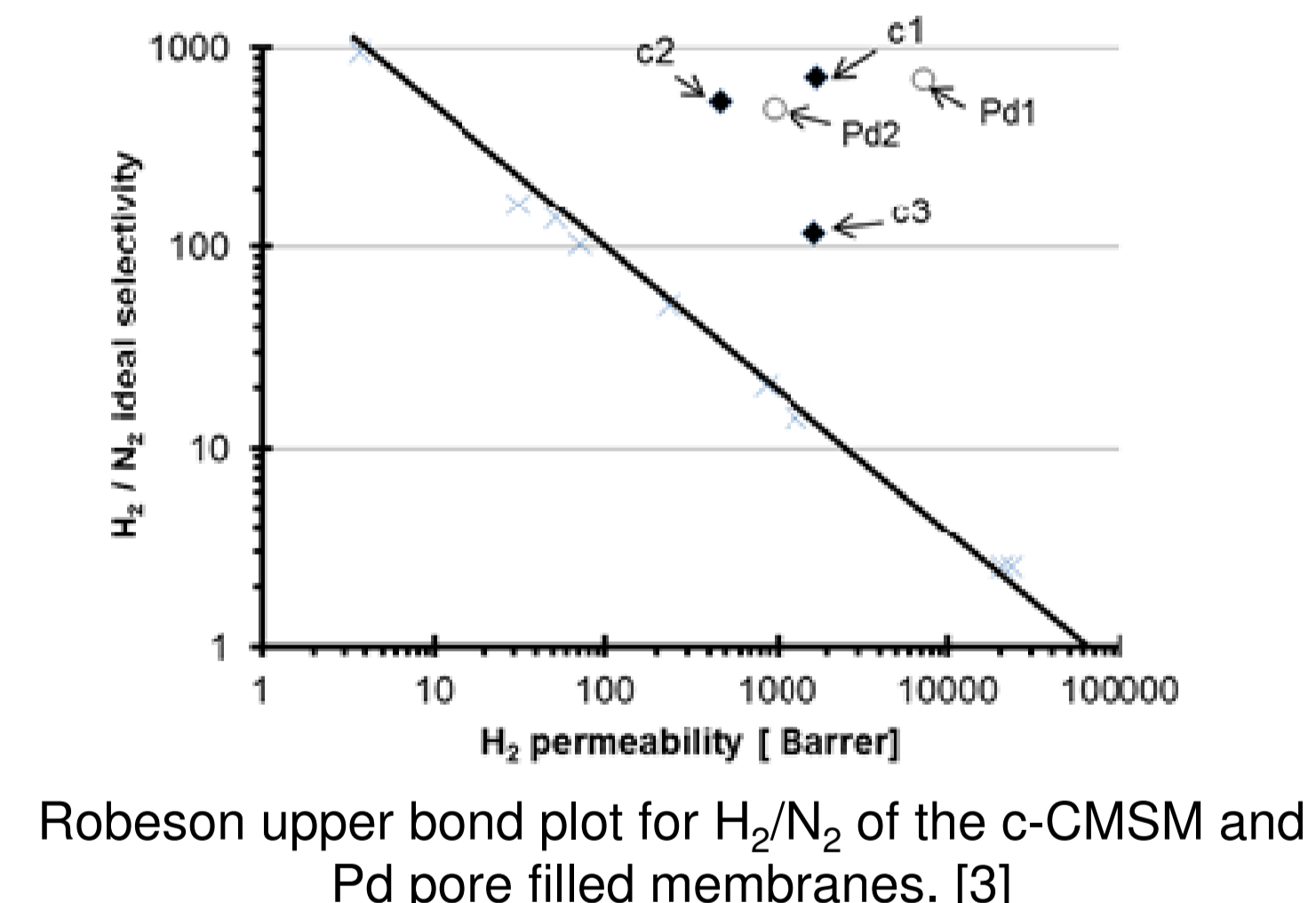
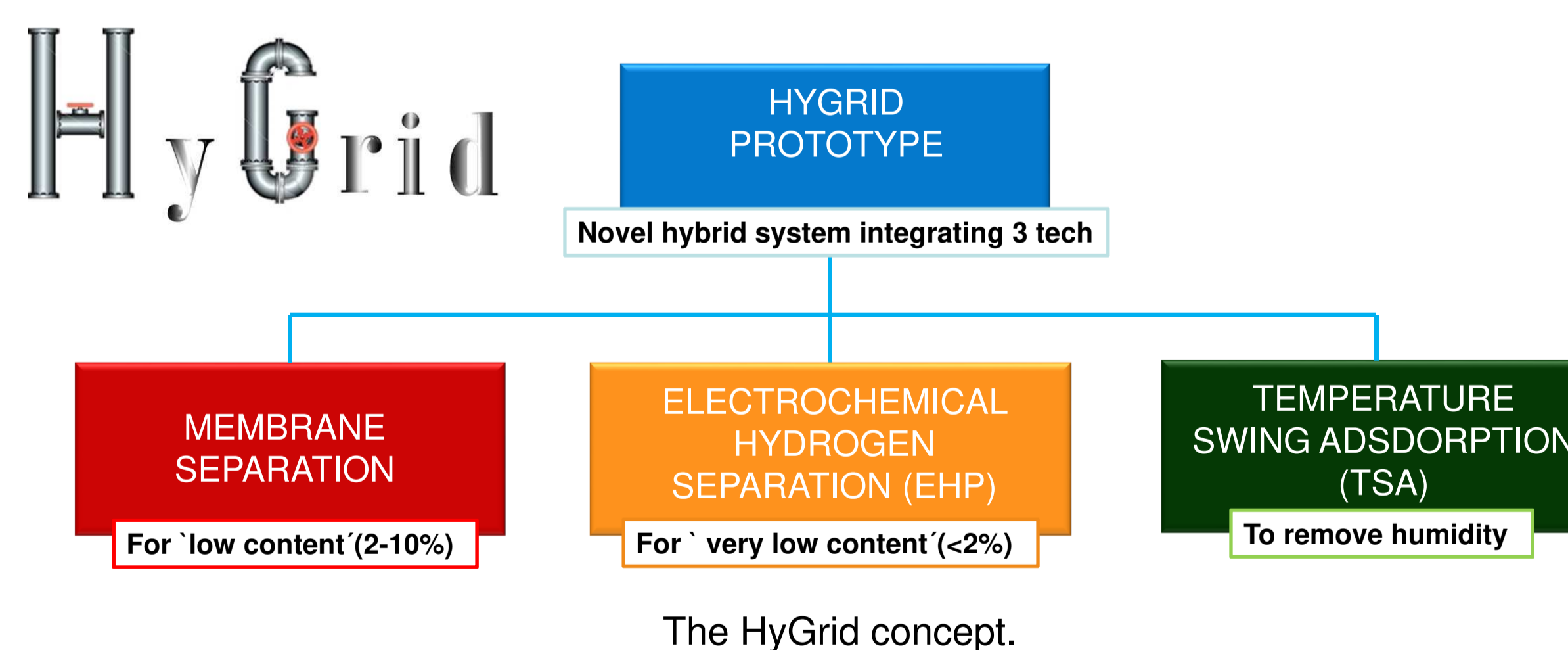


PERMEATION TEST OF CMSM



The HyGrid project. Flexible hybrid Separation System for H₂ Recovery from Natural Gas Grids

The HyGrid project proposes an integral solution for developing of an advanced high performance, cost effective separation technology for direct separation of hydrogen from natural gas networks. The HyGrid consortium consists of 7 European organizations from 4 countries (Netherlands, Spain, Italy and Switzerland)



Conclusions

- ✓ CMSM are versatile membranes that have higher permeation properties than polymeric membranes and are able to surpass the Robeson plot limits.
- ✓ In the BioHysis project, CMSM prepared from PEI show high permeation and selectivity towards CO₂ than methane and can be used for biogas upgrading. The permeation in CMSM increases with temperature.
- ✓ In the HyGrid project, Al-CMSM and Pd/Ag silver membranes will be developed for H₂ recovery from natural gas grids, promising results are being obtained.

References

- [1] LLOSA TANCO, M.A., PACHECO TANAKA, D.A., RODRIGUES, S., MENDES, A. Composite- alumina-carbon molecular sieve membranes prepared from Novolac resin and Boehmite. Part I: Preparation, characterization and gas permeation studies. Int. J. Hydrogen. Energy, v. 40, n. 16, p. 5653-5663, 2015..
- [2] LLOSA TANCO, M.A., PACHECO TANAKA, D.A. Recent advances on carbon molecular sieve membranes (CMSMs) and reactors. Processes, v. 4, n. 3, p. 29, 2016.
- [3] MELENDEZ, J., FERNANDEZ, E., GALLUCCI, F., VAN SINT ANNALAND, M., ARIAS, P., PACHECO TANAKA, D. A. Preparation and characterization of ceramic supported ultra-thin (~1 μm) Pd-Ag membranes. J. Membr. Sci., v. 528, p. 12-23, 2017.

Acknowledgements

- The HyGrid project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking under grant agreement No 700355. This Joint Undertaking receives support from the European Union's Horizon 2020 Research and Innovation programme and Hydrogen Europe and N. ERGHY.
 - The BioHysis project has received funding from the Government of the Basque Country and from FEDER through the GAITEK Programme under grant number IG-2014-00075 and IG-2015-0000175.
 - M. Llosa is grateful for the Torres Quevedo Programme PTQ-13-06153 and for the European Commission through the project TIFER (PEOPLE-2010-COFUND), grant No. 267200.
- Note: "The present publication reflects only the author's views and the FCH JU and the Union are not liable for any use that may be made of the information contained therein".