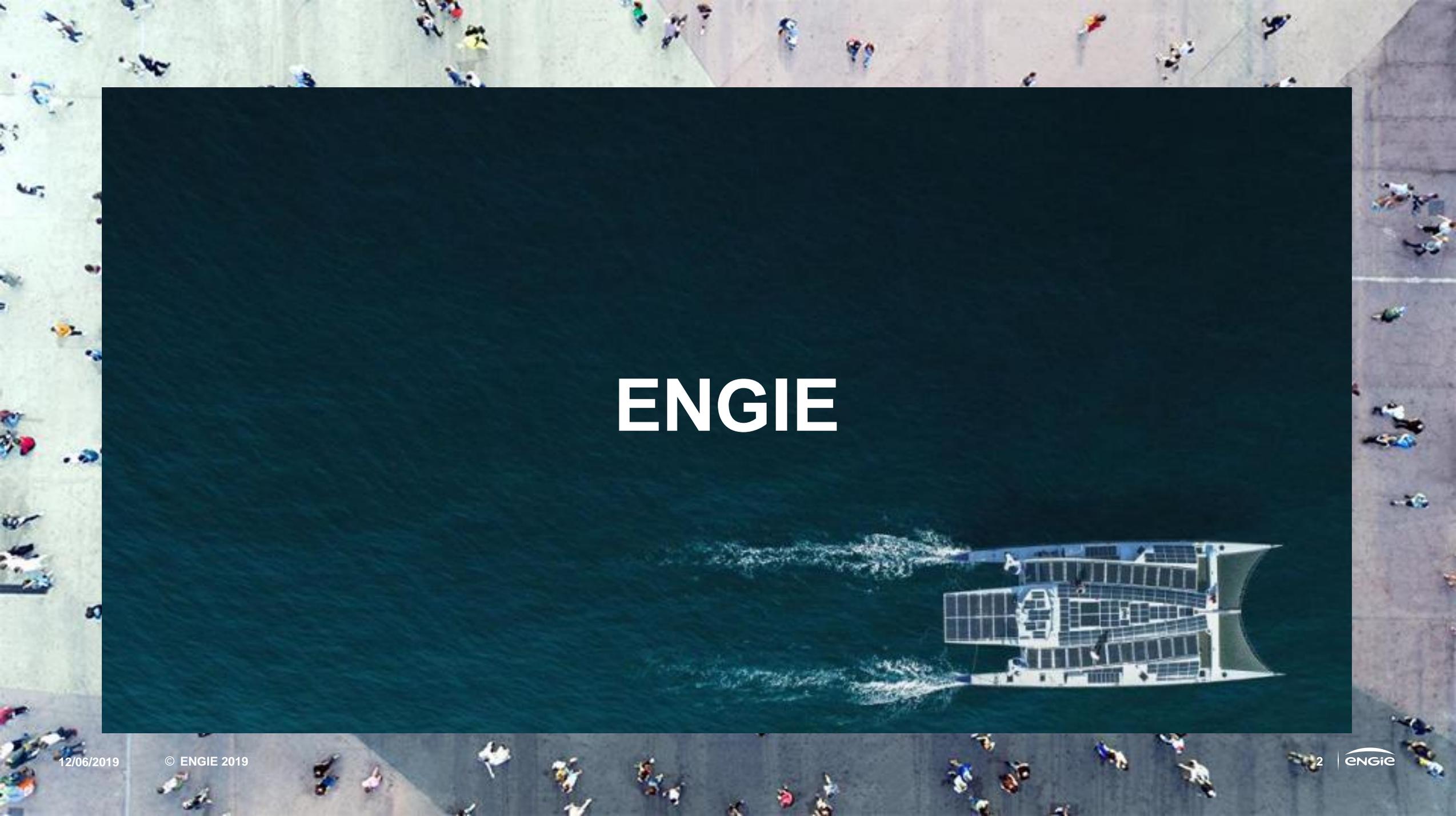


Applications of nanomaterials in the activities of an Energy Utility

L. BARATON – ENGIE Lab CRIGEN

06/12/2019 – EuroNanoForum - Bucharest





ENGIE

ENGIE TODAY



€65 bn
in revenues



Business activities
in around
70 countries

155,000
employees worldwide



24 million
customers worldwide



102.7 GW
of installed electricity
generation capacity

1,100
researchers and experts
in 11 research
and development centers



€16 billion
growth investments over 2016-2018
including **€1** billion
in innovation and digital



WE'VE IDENTIFIED A NEW WAVE IN THE ENERGY TRANSITION LED BY LOCAL AUTHORITIES AND CORPORATES



DECARBONIZATION



DIGITALIZATION



Local Authorities

Corporates

DECENTRALIZATION



Emerging Materials @ ENGIE

EMERGENT MATERIALS : A DEFINITION

Materials can be defined by two main properties :

- **Composition** : elementary composition of the material
- **Shape** : Structuration of the material. This encompasses the meso and macrostructure of the material.

Innovation in both properties allows the development of **new functionalities**.

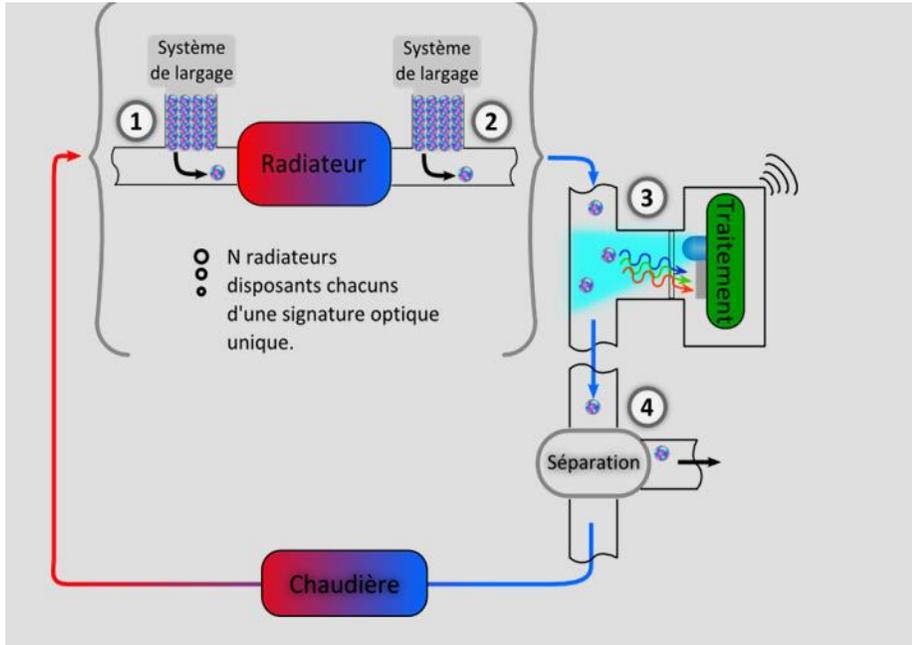
Emergent materials are mainly linked to the discovery and mastering of innovative and disruptive **building blocks** as well as **techniques** that allow their **manufacturing and implementation** in applications.

FROM EMERGING MATERIALS TO CUSTOMERS

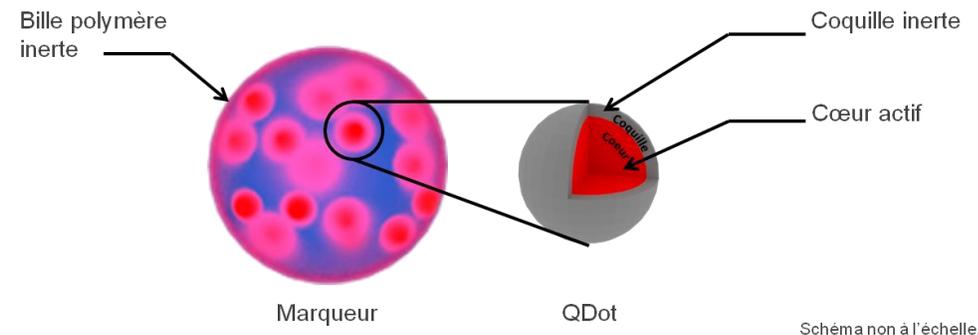
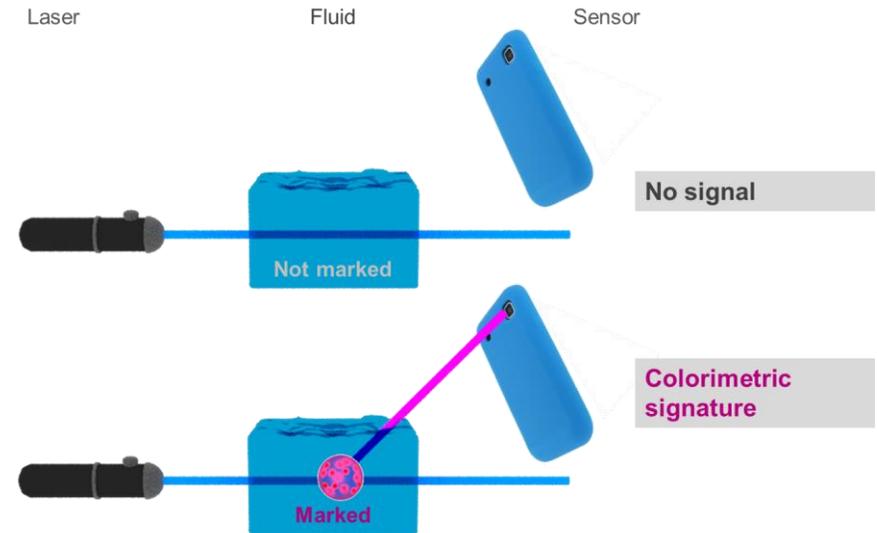


EMERGENT MATERIALS @ ENGIE RESEARCH 1/3

0D MATERIALS: QUANTUM DOTS AS FLOW AND THERMAL PROBES



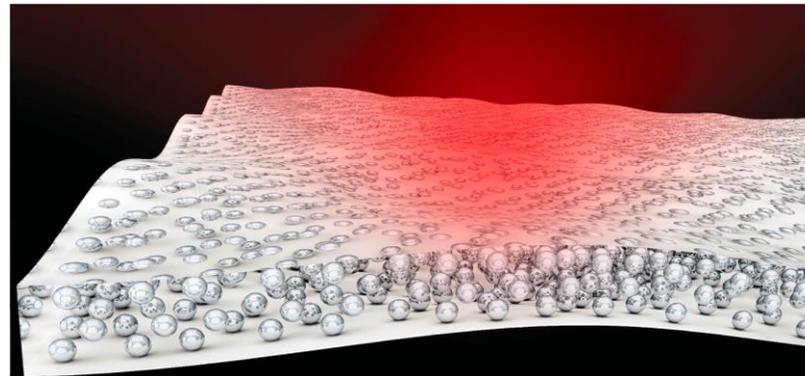
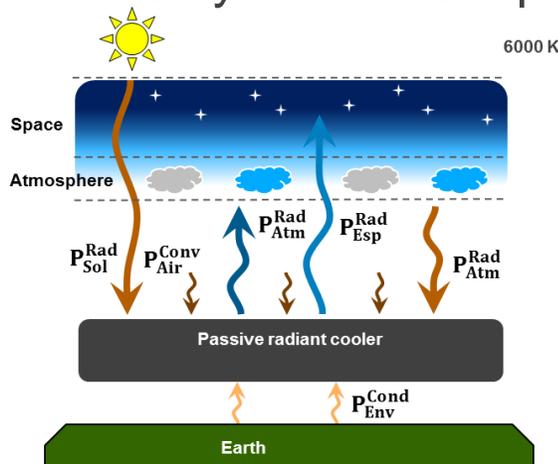
Particulate probes containing QDots are used in a local heating system to characterize flow and energy consumption.



EMERGENT MATERIALS @ ENGIE RESEARCH 2/3

THIN FILMS & COATINGS: CYGNUS

- Hybrid materials can radiate infrared in the atmosphere transparency window (8-13 μ). Once insulated from surrounding heat (air & radiations), this material cools down.
- Enables passive dry cooling
- Enabled by micro/nanoparticles embedded in low-cost materials.



Zhai, Y. *et al.* Scalable-manufactured randomized glass-polymer hybrid metamaterial for daytime radiative cooling. *Science* **355**, 1062–1066 (2017).

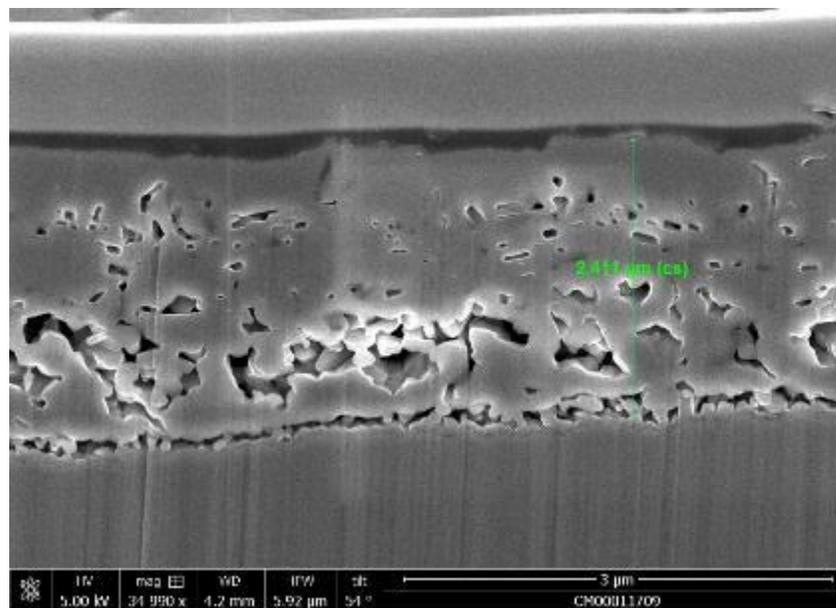
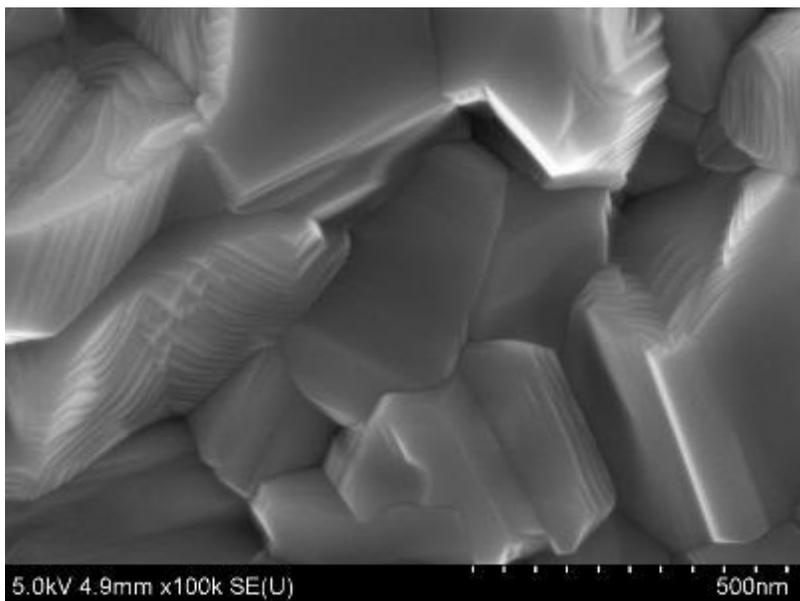
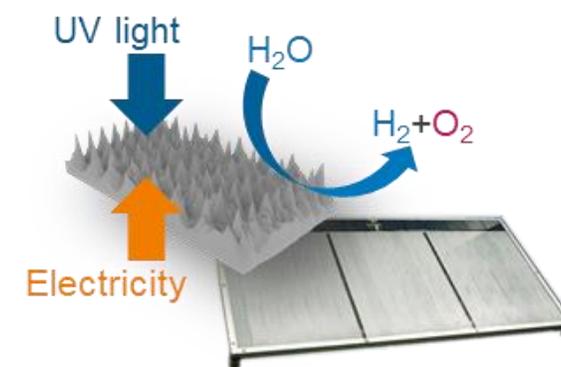
Embedded resonant polar dielectric microspheres randomly in a polymeric matrix, resulting in a metamaterial that is fully transparent to the solar spectrum while having an infrared emissivity greater than 0.93 across the atmospheric window. When backed with a silver coating, the metamaterial shows a noontime radiative cooling power of 93 watts per square metre under direct sunshine.

Contact: G. Levaufre – ENGIE Lab Nano

EMERGENT MATERIALS @ ENGIE RESEARCH 2/3

THIN FILMS & COATINGS: NANOH_2

- Photocatalytic thin films (few microns thick) with a nanostructured surface.
- Mastering of manufacturing processes and characterizations (composition, shape and properties).



Contact: L. Baraton – ENGIE Lab H_2

EU INVOLVEMENT: SUNRISE

SUNRISE Goals

A Coordination and Support Action (CSA) candidate to develop a European large-scale research initiative, based on:



The provision of sustainable fuels from renewable energy
-solar fuels-



The synthesis of commodity chemicals from renewable energy
-solar chemicals-



The development of efficient methods to recycle CO₂, from the atmosphere

EU INVOLVEMENT: SUNRISE

SOLAR ENERGY FOR A CIRCULAR ECONOMY

Be a change maker &
Join our community!

sunriseaction.eu



contact@sunriseaction.eu





 This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 816336

MATERIALS OUTLOOKS @ ENGIE RESEARCH

- Acoustic damping for windmills (suppression of the “WOUF” effect).
- Insulating materials (aerogels, biosourced insulator) – Lab Future Buildings
- Refractory materials – Lab Future Industry
- Gaz storage in mesoporous material (Prodia H2020 project) – Lab Biogas Biomass + Lab H₂
- Ceramics for SOFC and SOEC
- ...

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