



## STORAGE RESEARCH INFRASTRUCTURE ECO-SYSTEM

### RI Information sheet 2023

Organisation, Hellenic Mediterranean University

Materials, Growth procedure, Electrochemistry, Energy storage

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Project Acronym	StoRIES
Call	H2020-LC-GD-2020
Grant Agreement No.	101036910
Project Start Date	01-11-2021
Project End Date	31-10-2025
Duration	48 months

1. Photo

<https://cuttematerials.hmu.gr/>



2. Geographical coordinates (°, ′, ... N/S, E/W)

Not known.

3. Description of the research infrastructure for the webpage

The Cutting – Edge Materials for Electrical Energy Storage and Efficiency Group is dedicated to the development of highly reliable, controllable and throughput deposition processes of next-generation materials (i.e. thin films, nanostructures and nanocomposites) for energy storage and efficiency technologies including fuel cells, batteries, capacitors and superconductors.

Growth techniques: PECVD, electrodeposition and electrospraying

Characterization methods: XRD, Raman spectroscopy, FE-SEM, coin cell evaluation, cyclic voltammetry and electrochemical impedance spectroscopy, contact angle measurements.

The Group offers growth manufacturing processes for pure/multi metals, alloys, oxides as well as carbon allotropes with:



- Great degree of flexibility: Atmospheric Pressure Chemical Vapour Deposition (APCVD) system
- Low cost: Spray Pyrolysis
- High purity: Low Pressure Chemical Vapour Deposition (LPCVD) system
- High-Yield & Up-scalable: Plasma Enhanced Chemical Vapour Deposition (PE-CVD) system
- Substrate cleaning & modification: Ar/O<sub>2</sub> Plasma source

In addition, the Group is offering material characterisation equipment for analyzing the properties of the materials developed by the above-mentioned growth equipment:

Structure: Fourier-transform infrared spectroscopy (Shimadzu)

Morphology: Scanning Electron Microscopy with Energy Dispersive X-ray analysis (JEOL 840)

Electrical: 2-point and 4-point probe conductivity/resistivity set-up

Electrochemical: Cyclic Voltammetry, Electrochemical Impedance Spectroscopy (AUTOLAB potentiostat/galvanostat)

Other: Contact angle measurement set-up, Photocatalytic measurement set-up, Electrochromic and thermochromic measurement set-ups, Shimadzu UV-VIS spectrophotometer, Ion chromatography, Gas chromatography

**Services currently offered by the infrastructure:** The scientific achievements of the growth manufacturing processes are summarized below:

1. Electroactive metal oxide (V<sub>2</sub>O<sub>5</sub>, VO<sub>2</sub> (B), WO<sub>3</sub>, MnO<sub>2</sub>, α-Fe<sub>2</sub>O<sub>3</sub>) based structures suitable for the fabrication of electrodes for fuel cells, supercapacitors, Li<sup>+</sup>, Mg<sup>2+</sup> batteries.
2. Metal oxide nano/microstructures (ZnO, TiO<sub>2</sub>, V<sub>2</sub>O<sub>5</sub> and WO<sub>3</sub>) exhibiting significant photocatalytic action suitable for the degradation of gas and liquid pollutants.
3. Growth of thermochromic V<sub>1-x</sub>W<sub>x</sub>O<sub>2</sub> layers with low transition temperature suitable for energy saving in buildings.
4. Growth of electrochromic WO<sub>3</sub> layers with fast response and high coloration efficiency.

Our facilities are currently utilized by the Department of Chemistry (UCC), Department of Chemistry (Imperial College London), Department of Chemistry (University College London) and Luxembourg Institute of Science and Technology regarding the electrochemical characterization of their samples (V2O5, Doped V2O5, Si/Carbon Nanotubes/Stainless Steel, TiO2/Carbon Nanotubes/Stainless Steel and Perovskites). Through this collaboration, joint publications (e.g. Journal of Electrochemical Science and Engineering 10 (2020) 257, Molecules 25 (2020) 5558) and proposals have been recently submitted (Marie-Curie Research Fellowship), and others are in the submission process.

#### 4. Availability of the research infrastructure

(Please indicate time periods in which infrastructure will not be available for StoRIES in the next 2 years – if already known)

The infrastructure will not be available July-August 2024 and 2025.

#### 5. Special considerations (confidentiality / NDA agreements, insurance requirement, special training, HSE training)

There are not special considerations.

#### 6. Energy storage technology that can be analysed/studied by using the research infrastructure

- Electrochemical
- Chemical
- Thermal
- Mechanical
- Superconducting Magnetic
- Cross-cutting  (Specifically: ... )

#### 7. Key words for the webpage

Cathodes, Anodes, Cyclic voltammetry, Cell, Electrochemistry

#### 8. TRL level (if applicable):

- 1-3
- 4-6
- Above