

2D nanomaterials for Energy Storage

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aplicada

1. Introduction: State of the art

Batteries

Characteristics

- Chemical energy → Electric energy
- Slow charge-discharge
- Low-medium cyclability
- High energy density

Classification

- Primary cells: Zn/MnO Zn/air
- Secondary cells: acid Pb, NiMH, Li ion

- High OCP
- Low self-discharge
- High gravimetric and volumetric energy

Intercalation (graphite) Insertion (Si, Ge, Sb)

Supercapacitors

Characteristics

- Energy from electrostatic different
- Fast charge-discharge
- High cyclability
- High power density

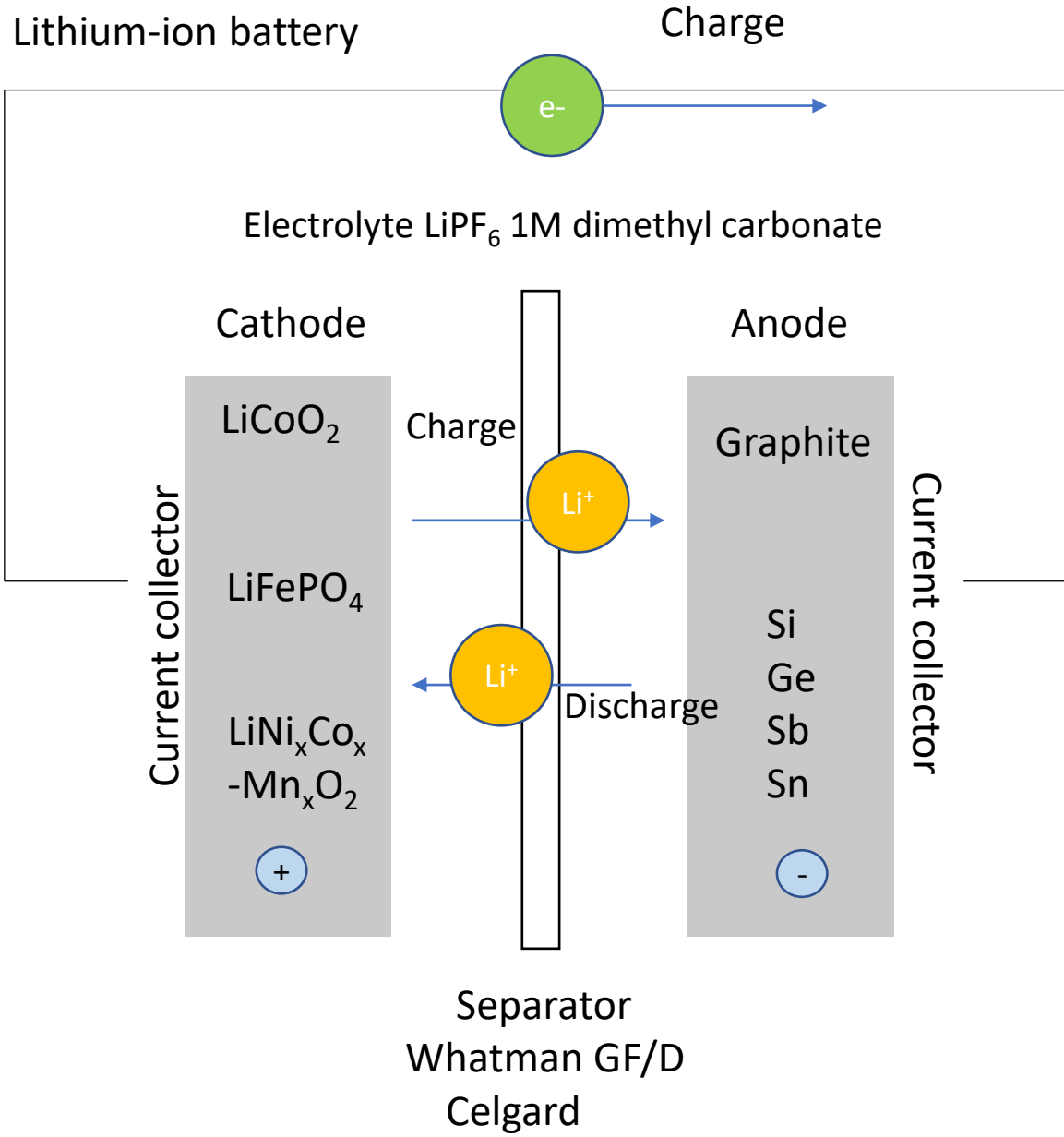
Classification

- ECDL
- Pseudocapacitors
- Capacitores híbridos

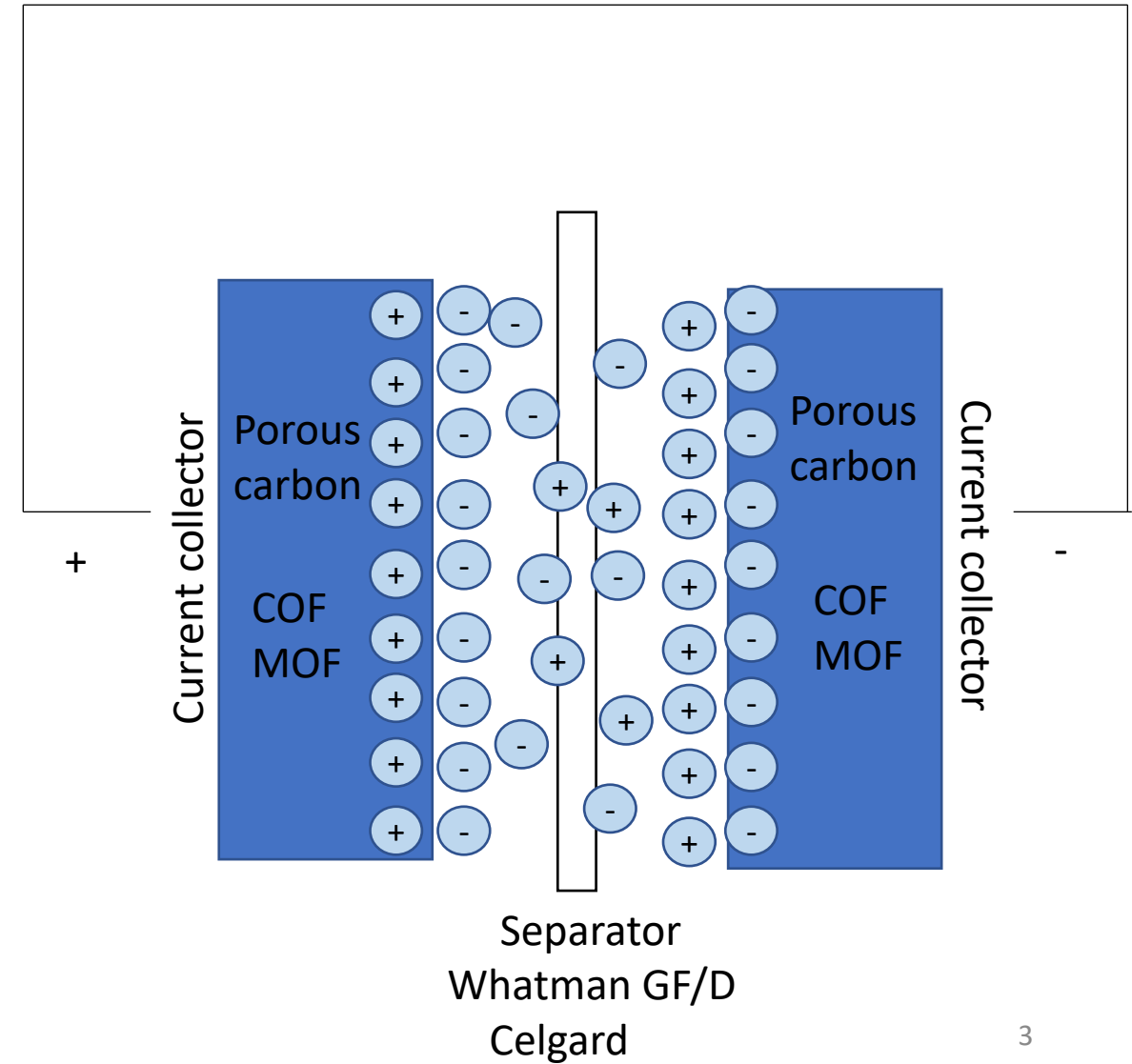
- High porosity carbon
- Control of pore size: MOFs, COFs

1. Introduction: State of the art

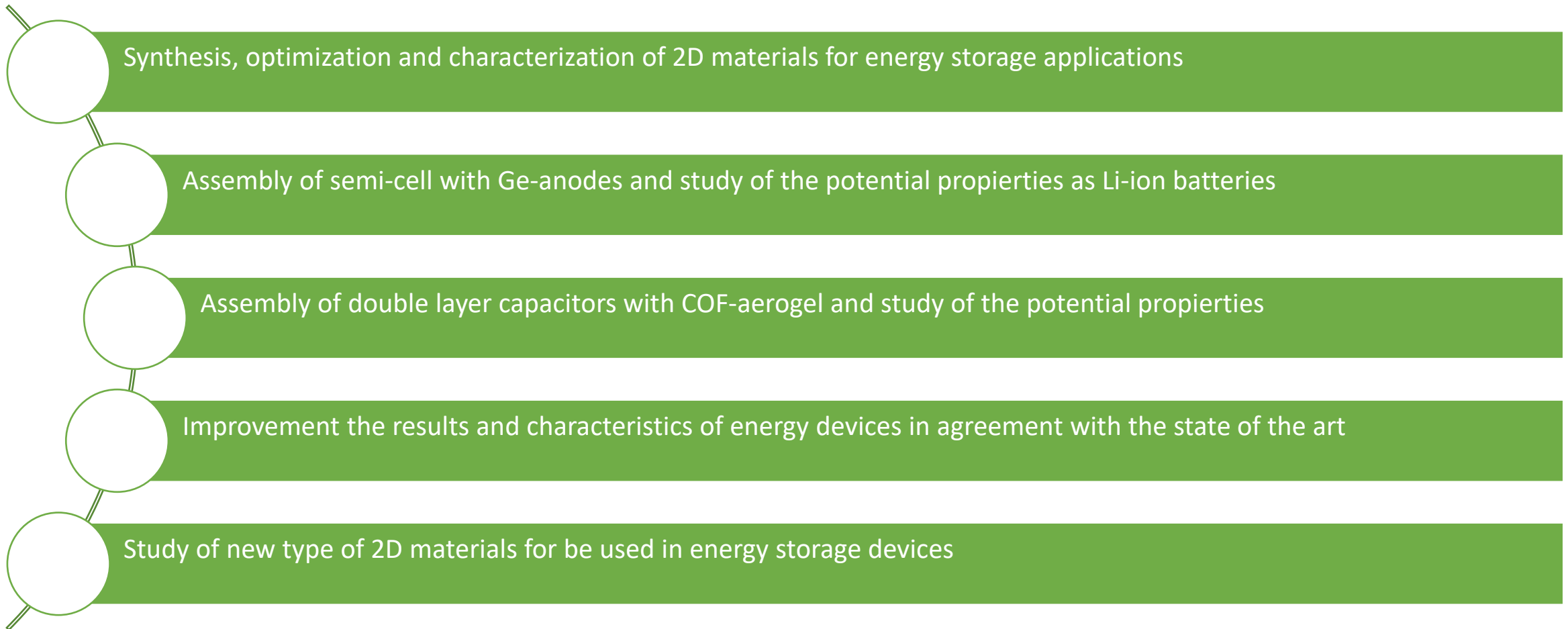
Lithium-ion battery



Double layer capacitor



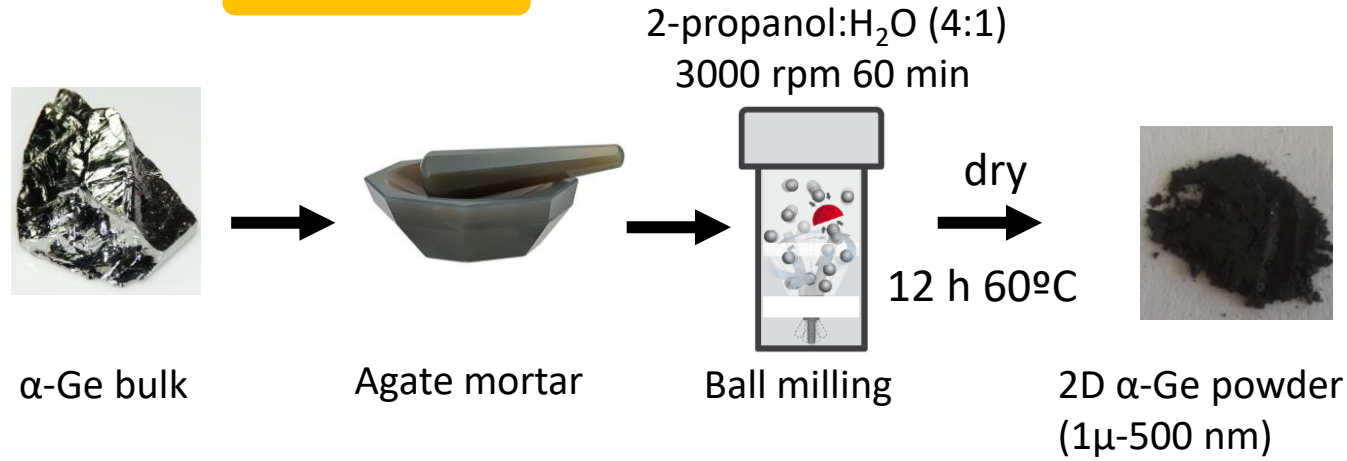
2. Objectives & research plan



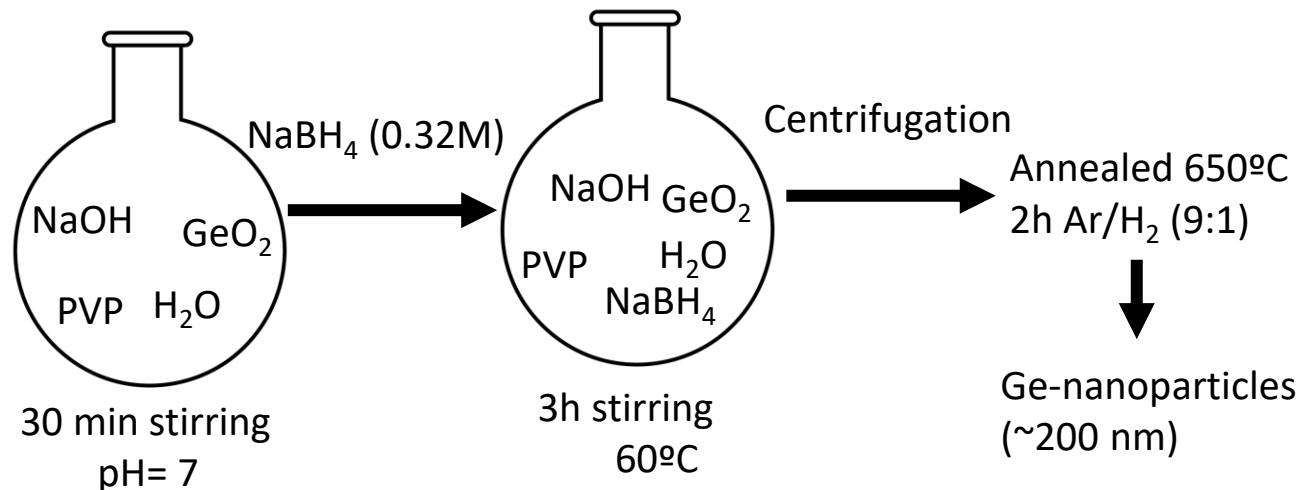
3. Metodology: Ge with different sizes for Lithium-ion batteries

Synthesis

Method 1:

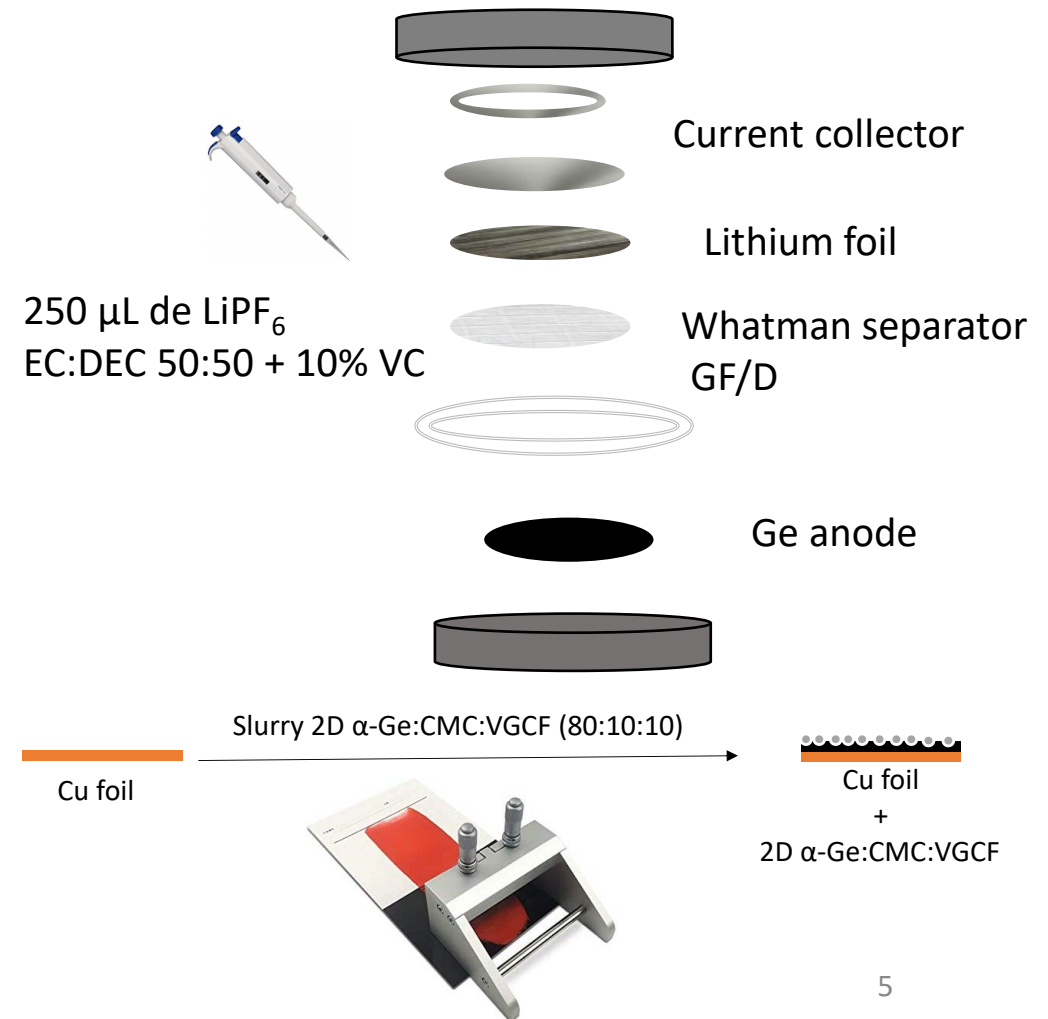


Method 2:



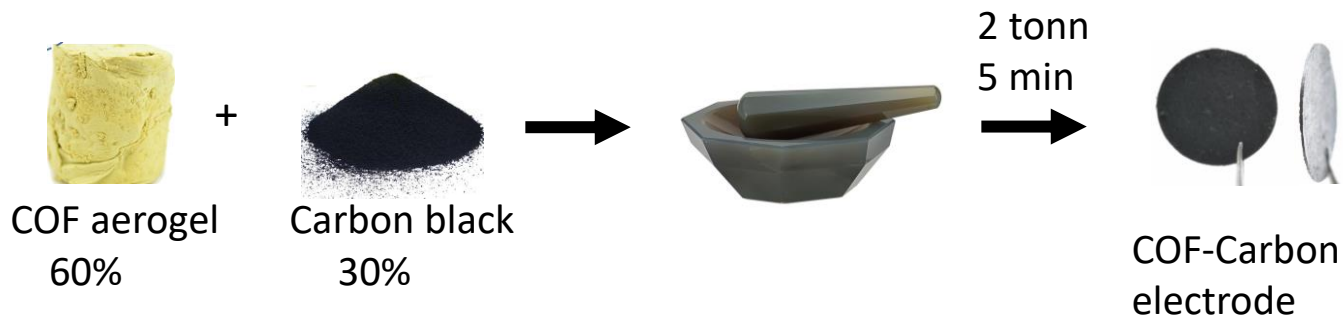
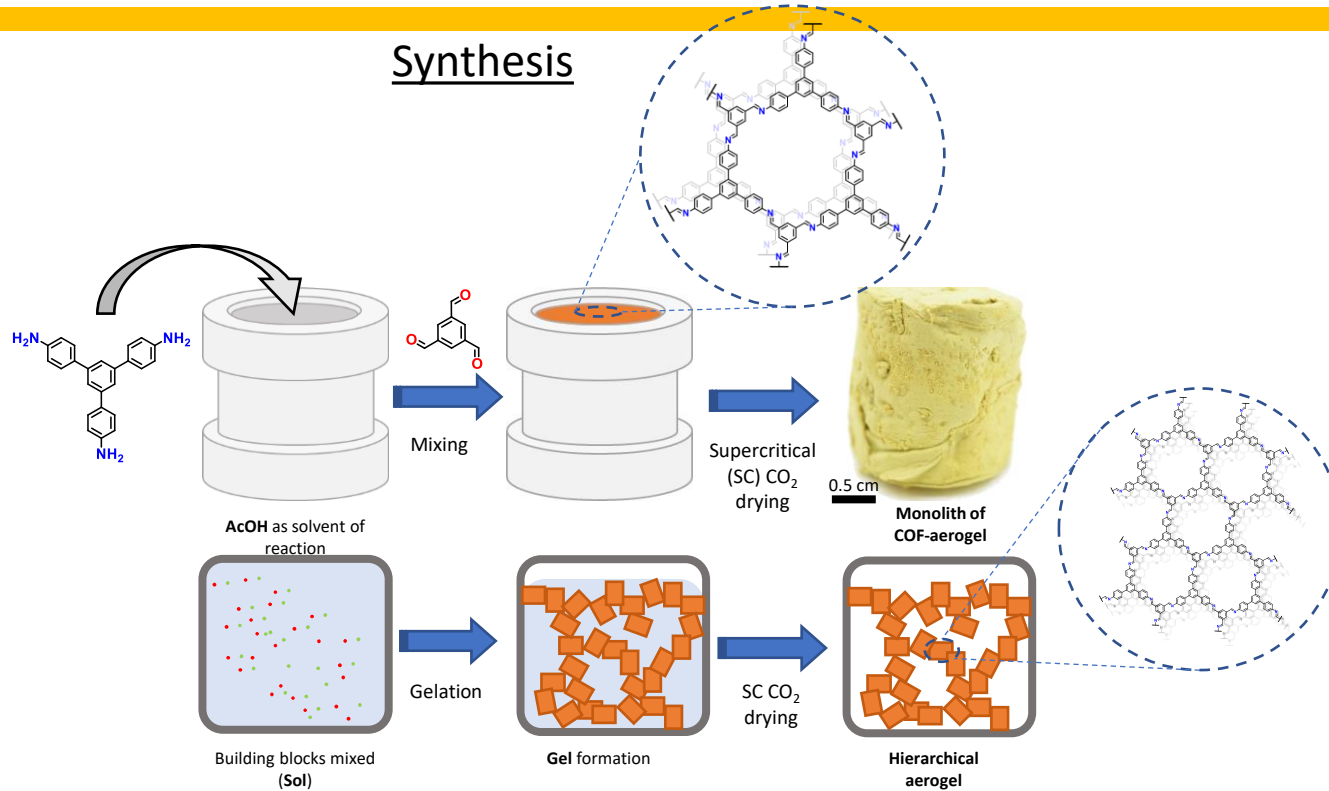
Cell assembly

COIN CELL 2032-two electrode configuration



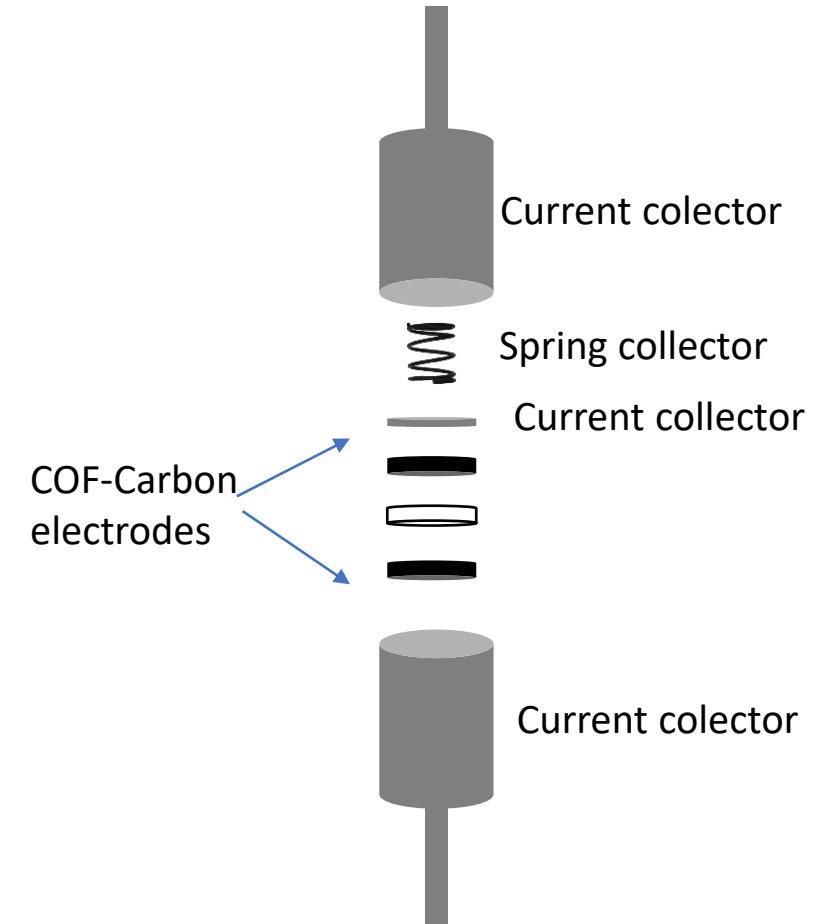
3. Metodology: COF Aerogels as electrode for Double Layer Capacitors

Synthesis



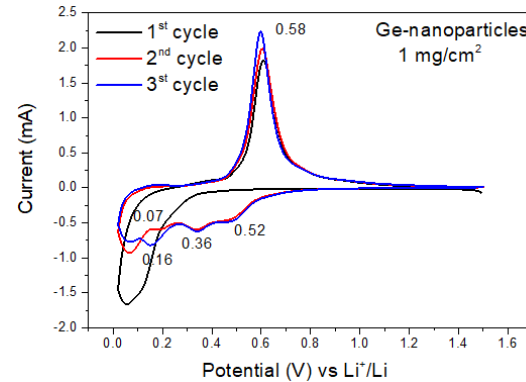
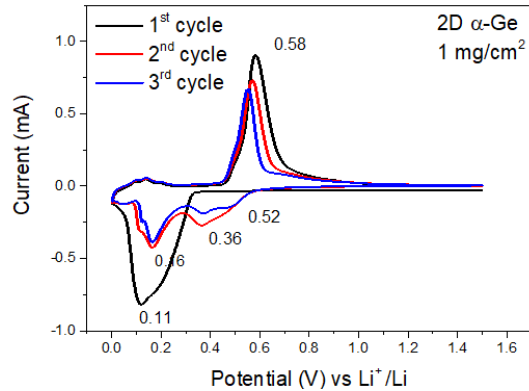
Cell assembly

Swagelock® cell two-electrode configuration

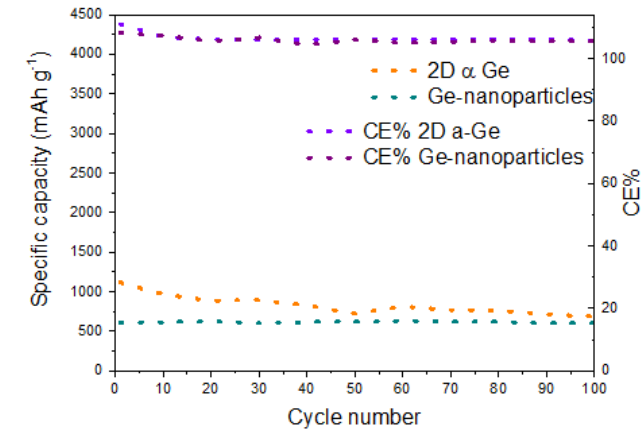


4. Results: Ge with different sizes for Lithium-ion batteries

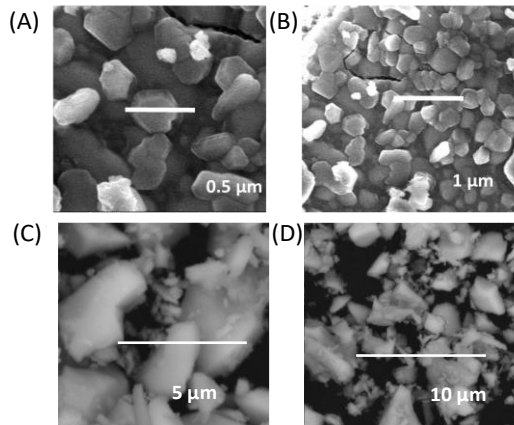
Cyclic voltammetry 0,1 mV s⁻¹



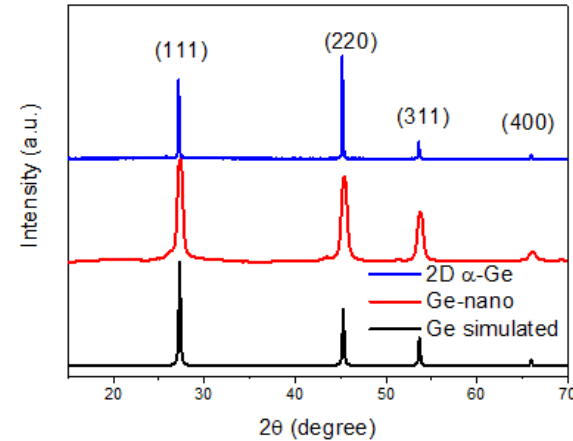
Galvanostatic charge-discharge 0,5C



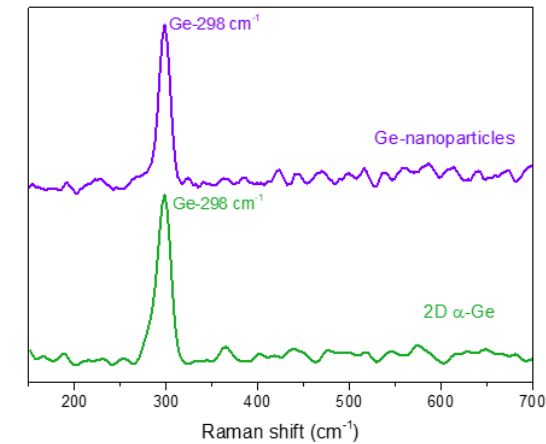
Scanning electron microscope (SEM)



X-ray diffraction

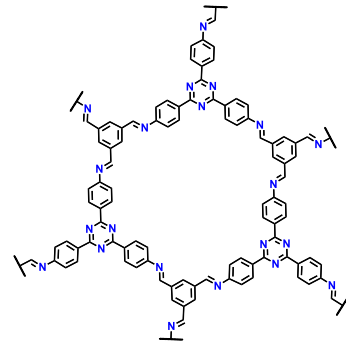
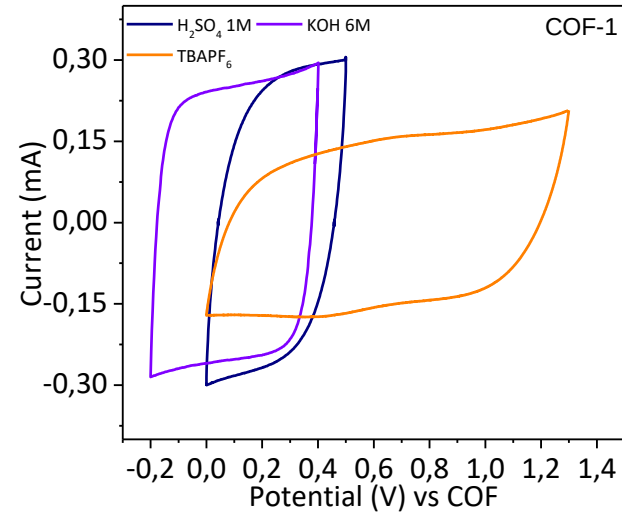


Raman Spectroscopy

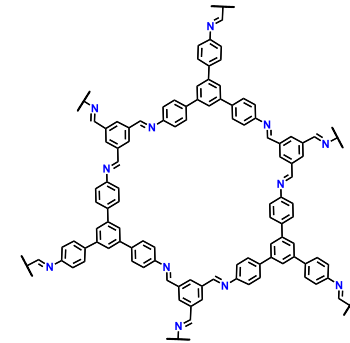
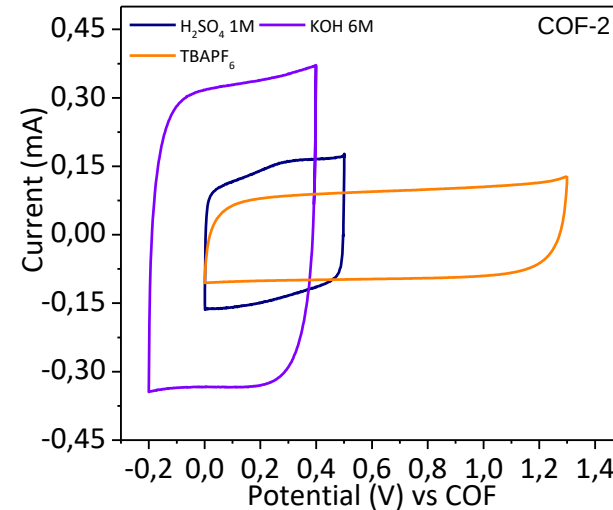


4. Results: COF Aerogels as electrode for Double Layer Capacitors

Cyclic voltammetry 100 mV s^{-1} for three different electrolytes



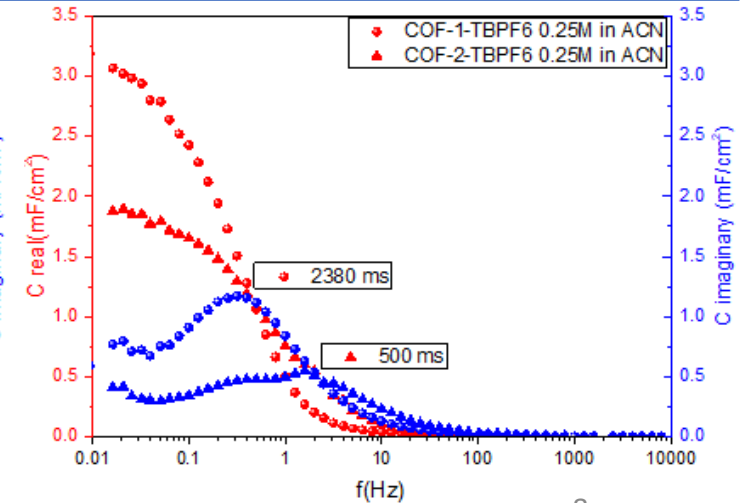
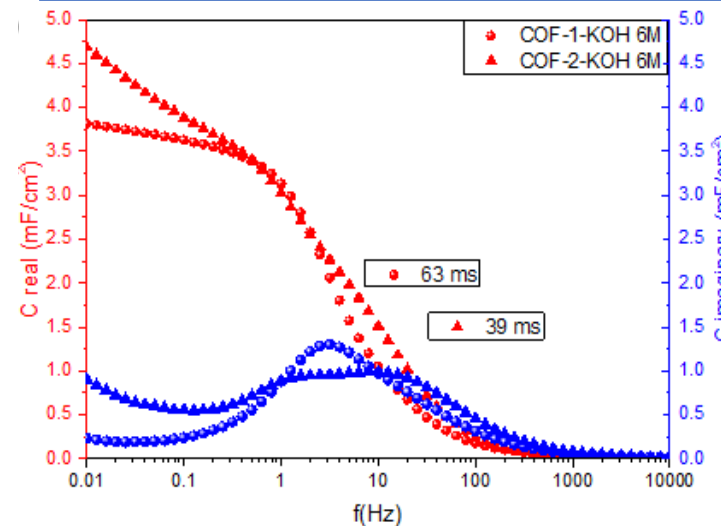
TZ-BTCA-COF (COF-1)



TAPB-BTCA-COF (COF-2)

Measurement	Areal capacitance (mF/cm ²) in 100 mV/s
TZ-BTCA-COF-KOH 6M	8,95
TZ-BTCA-COF-H ₂ SO ₄ 1M	7,95
TZ-BTCA-COF-TBAPF ₆ 0.25M	5,12
TAPB-BTCA-COF-KOH 6M	11,9
TAPB-BTCA-COF- H ₂ SO ₄ 1M	5,20
TAPB-BTCA-COF-TBAPF ₆ 0.25M	3,62

Electrochemical impedance spectroscopy for KOH 6M and TBAPF₆ 0.25M in ACN



5. Conclusions & outlook

- ❖ The values obtained for Ge-anode in semi-cell show promising values in comparison with previous reported
- ❖ COF-aerogel show properties for be used as electrode materials on Electrochemical Double layers capacitors
- Is expected improved the properties of Ge-anode semi-cell and test the electrodes in full cells.
- For COF-aerogel materials the next step is improved the capacitance with new structures and with modifications with carbon materials