

## ABOUT THE PROJECT

The ARMS project aims to create **eco-friendly supercapacitors with high energy density** (>50 Wh/kg) comparable to batteries. By integrating **graphene-rich carbon materials** and employing **atomic layer deposition (ALD)** manufacturing, we **maintain power density, cycle life, and eco-friendliness**. This effort establishes a new value chain for supercapacitor manufacturing, with European SMEs as key players. Our approach involves:

- ✓ process modification for high-graphene-content porous carbon,
- ✓ graphene coating on carbon fibers,
- ✓ ALD coating for electrode stability and increased voltage window
- ✓ Development of eco-friendly electrolytes.

This project aims to develop innovative management systems enabling the replacement of batteries with supercapacitors in two demo cases: 1) wireless sensors for environmental monitoring in logistic systems powered by a printed flexible supercapacitor, and 2) a drone with structural supercapacitors integrated into its design.

## OUR TEAM



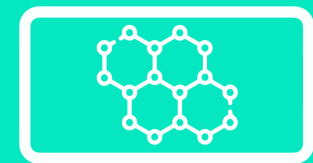
## CONNECT WITH ARMS

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- [@ARMS\\_project\\_](#)
- [www.arms-project.eu](http://www.arms-project.eu)
- [matti.mantysalo@tuni.fi](mailto:matti.mantysalo@tuni.fi)



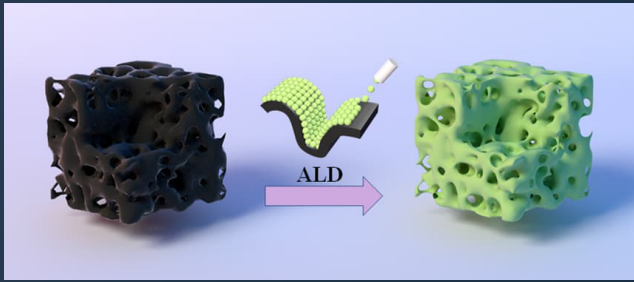
This project is funded by the European Commission's Horizon Europe programme and is part of the Graphene Flagship initiative, which advances technologies that rely on graphene and other 2D materials.

# ARMS



**ARMS - ATOMIC LAYER-COATED GRAPHENE**  
ELECTRODES FOR **MICRO-FLEXIBLE AND**  
**STRUCTURAL SUPERCAPACITORS**

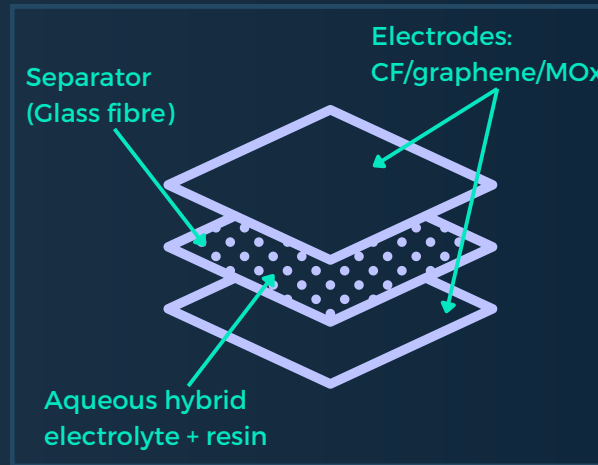
**SUPERCAPACITORS:**  
**ENERGIZE YOUR WORLD**



The core concept of ARMS

## OBJECTIVES

- 1 Synthesis of raw graphene-containing carbon-based electrode materials
- 2 Electrode fabrication
- 3 Electrode booster (ALD)
- 4 Electrolytes
- 5 Supercapacitor device integration and demonstration



Scheme of ARMS structural supercapacitor

## IMPACTS



### SCIENTIFIC:

- Breakthroughs in graphene-based biocarbon materials boosting supercapacitor energy density.
- Advancements in low-temperature ALD processes enhancing metal oxide film control.



### ECONOMIC:

- Fueling growth in IoT, organic solar cells, and smart electronics.
- Utilizing local resources to reduce energy storage costs.
- Driving demand for compact, efficient storage solutions, creating new markets.
- Promoting European autonomy in energy storage, reducing reliance on non-European resources.
- Enabling larger supercapacitor cells for grid stabilisation and renewable energy.



### SOCIETAL:

- Bolstering Nordic economies through bio-based resource utilisation.
- Reducing climate impact with sustainable materials and longer product lifespan.
- Minimizing environmental harm by replacing batteries with eco-friendly supercapacitors.
- Creating high-quality jobs in energy storage and electronics industries.
- Promoting a shift towards sustainable, regenerative product design.
- Facilitating the transition to green energy with new biocarbon materials.