



SELECTIVE ION TRANSPORT IN GRAPHENE OXIDE MEMBRANES AND CARTRIDGES

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State of the art

Filter geometry

- 2D-materials can act as nanometric sieves for ions.
- Ions can travel on long distances (cm-scale) in between graphene oxide (GO) nanosheets.
- Selective transport of anions and cations already demonstrated¹.



Figure 1. In plane (IP) and out of plane (OOP) ion trasport in macroscopic GO membranes **Figure 2.** Selective ion transport in GO on centimeter-scale from our previous work¹.

- Nanofiltration usually done on flat substrates.
- We deposit GO on industrial filters, made of tens of hollow micro-fibers (200 μm)
- The geometry allows to have a larger active filter area and higher throughput^{2,3}.





Figure 4. (a) Polyethersulfone Hollow fibers (HFs, Versatile PES[®]), (b) Versatile PES[®] filtration module (Plasmart 100)





Electro-migration set up

- Constant potential applied on opposite input and output of the filter (electrode A and electrode B).
- Ion migration monitored by electrochemical impedance spectroscopy (EIS) and atomic adsorption spectroscopy (AAS).



OUT



Figure 5. (a) ion movement inside a fiber, (b) SEM cross section of the fibers.

Preliminary Results

- The increase in VIAL 2 conductivity (Λ) is due to the transport of ions through the GO.
- Na⁺ can migrate better than Ca²⁺ inside the GO.
- Selectivity of ions transported seems to increase with % GO loading.



Figure 6. Instrumental set-up used for the ion transport, ions moved by an electric field in a cartridge.

Figure 7. (a) trend of the conductivity (Λ) of the solution in vial 2 vs. time, (b) Na⁺ (blue) and Ca²⁺ (red) transported at different GO loading in the filter.

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