



Your Companion  
Life Science Filtration

OPEN INNOVATION ECOSYSTEM  
FOR **SUSTAINABLE**  
NANO-FUNCTIONALIZED  
**PLASTIC & PAPER**  
SURFACES & MEMBRANE



## i3Membrane Use Case

# Selective and switchable water filter membranes



### Objective:

*Develop double-sided roll-to-roll coating of conductive layers on polymer membranes for electrically switchable filters in medical/biotech (case 1) and for particle analysis in pharmaceutical liquids (case 2).*

### Context

Electrically switchable membranes are not available on the market. Specific adsorption / desorption usually is done by time intensive pH shift or increased salt concentrations. Metal coated polymer membranes (Polyamide) have the ability to add digital properties by applying a voltage to adsorb and desorb charged biomolecules such as monoclonal antibodies. Active filter membranes increase market potential to e.g. syringe filters and other biotech filter applications (Case 1). Gold coated polyester membranes are used in pharma industries for particle analysis of liquids. Covid19-related increasing demands for particle monitoring of active agents trigger efforts to achieve higher production throughputs for membrane metallisation (Case 2). Polymer membranes turned out to be a challenging material for industrial high-volume coating technologies (roll-to-roll processing). For highly porous membrane types like PES and PET, thermal burden is a critical factor that may limit the process speed, whereas for 20 um thin track-etched membrane types, wrinkle formation must be controlled (PC membrane) and metal adhesion can be reduced (PET membrane). The current state of the art coating process in an evaporation chamber comes along with low membrane throughputs in the range of below 25 A4 sheets per day. Manufacturing of larger digital.

### Our ambition

- Increase productivity to at least 50 A4 sheet equivalents (approx. 3 sqm/8h);
- Increase yield to > 97% (apply in-line monitoring strategies);
- Optimise metal coating characteristics (e.g., mechanical stability) and membrane performance;
- Develop a robust interconnection technology to apply electrical voltage to the membrane;
- Application robust metal layers on ultra thin membranes under influence of electrical voltage and fluids;





## Intermediaries Results

- R2R sputter coating shown for 4 different membrane types

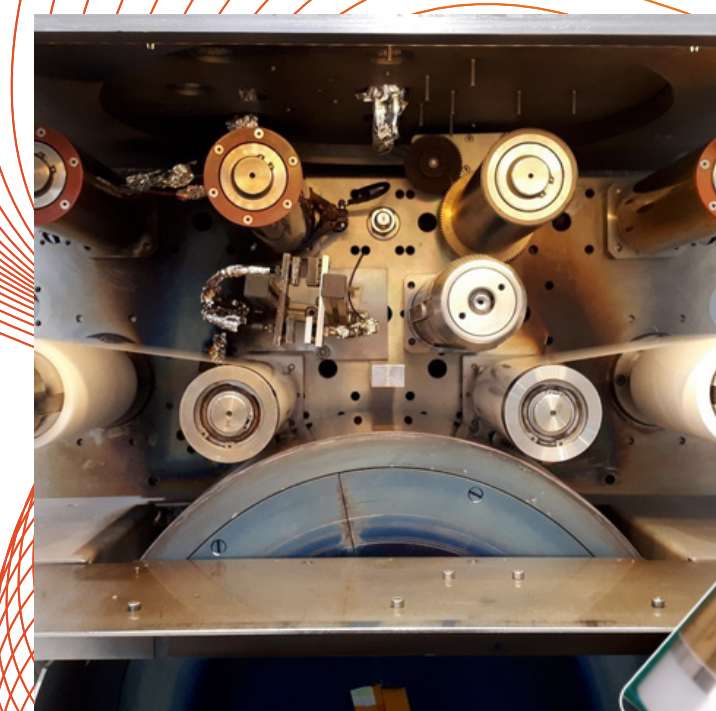
- a) Polyamide
  - b) PES, bilateral coating with up to 100 nm Au; up to 10 m membrane processed;
  - c) track-etched PET: 100 nm Au (one side); film adhesion optimized by means of plasma pretreatment;
  - d) track-etched PC: 40nm/20nm Au (bilateral coating): up to 20 m membrane processed; for wrinkle formation protective layer is currently introduced; sputter coating retrofit in Q2/2023 promises further optimization;
- First results for membrane interconnection received by ACP thermo-compressive bonding;
  - Life cycle analysis performed by ICP on base of switchable filter with 200 cm<sup>2</sup> with 100/100 nm gold
- a) Gold has the highest environmental impact compared with the polymeric filter components (making up > 99% of the overall filter mass)
  - b) Gold is favorable compared with Platinum
  - c) Gold can be recovered by more than 95% after removal of housing material by incineration of the membrane



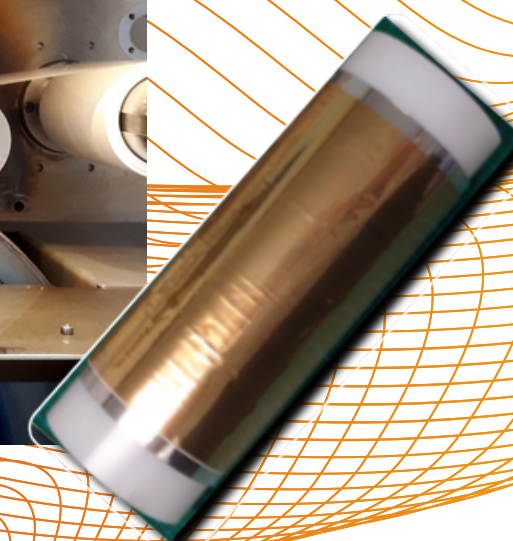
Case 1:  
Membrane  
based syringe  
filter by i3  
Membrane



Case 2: Gold coated  
polyester membrane  
for particle analysis of  
pharma liquids



R2R sputter  
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