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Ph.D. thesis (2022-2025)  
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# Fabrication of a full-paper point of care platform by additive manufacturing

*Elaboration d'un dispositif de diagnostic médical en papier par procédé de fabrication additive*

## Context / Objectives

### Actual nucleic acid amplification tests (NAATs) :

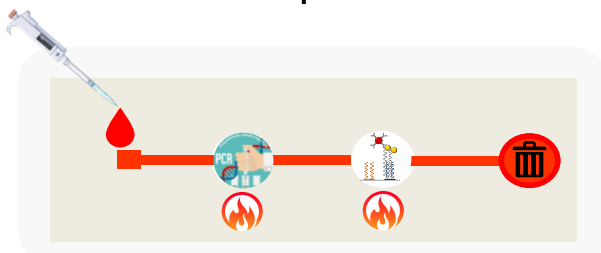
- Performed in centralised laboratories
  - Requires equipment and trained personnel
- Bottleneck for a rapid disease diagnostic

### Point of care testing (POC) :

- Defined as a test performed near or at the patient's place of residence
- Rapid results requiring minimal user intervention
- Production of plastic waste

### CareFab project :

The objective is to develop a **printed microfluidic paper-based device** ( $\mu$ PAD) integrating all unit operations necessary for **nucleic acid amplification tests** and of the associated **fabrication process**.



Funded by: **anr**

In collaboration with AlpRobotic

## Methods

### Printing processes

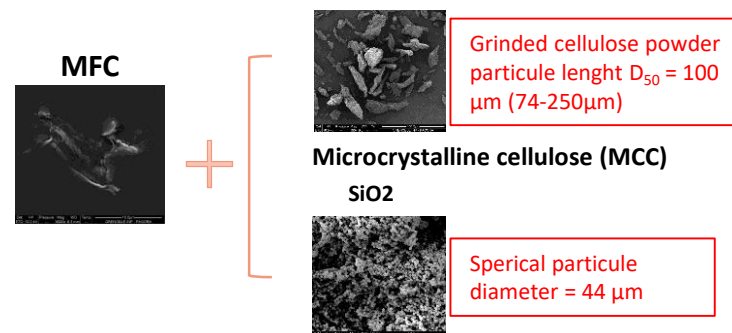
6 axis robot

- Multiple printing tools :
  - Dispenser printing
  - Spray deposition
  - Jetting
- 3D substrates
- Various shape of design



### Cellulose $\mu$ -particle aqueous inks:

porous cellulose based materials with high capillary suction can be elaborated using cellulose-nanofibers (CNF),  $\mu$ -particles and SiO<sub>2</sub> as inert filler

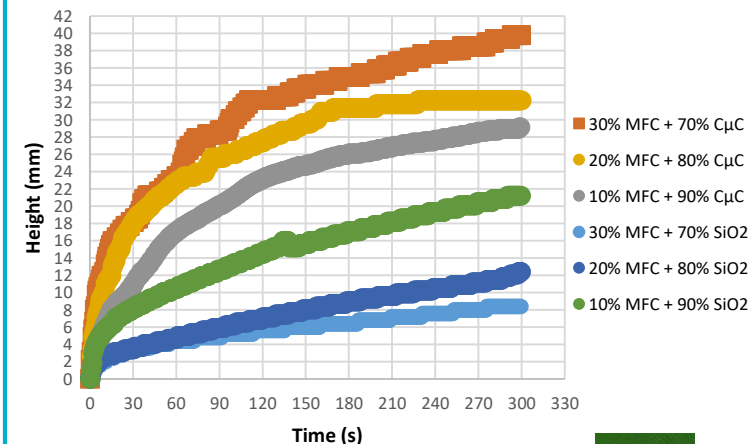


- 3 ratios tested : 10 - 20 - 30 % MFC + 90 - 80 - 70 % secondary components

## Results

### Capillarity path

- Capillarity is faster with C $\mu$ C then with SiO<sub>2</sub> due to pore size
- Too many large pores induce strip stratification and therefore less accessible porosity
- Comparison with High Flow references



### Process

- Different printings parameters depending on the formulation
- Design of the experimental device to measure the capillary velocity

