

# Challenges of printing on brittle and delicate substrates and membranes

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Printed sensors, both on flexible substrates and directly on the skin, have been shown to have great potential for developing wearables and point-of-care devices. For this reason, integrating sensors by printing methods into already developed mussel-inspired membranes as artificial skin for tissue regeneration is of great interest not only for sensing on the skin, but also for treating wounds.

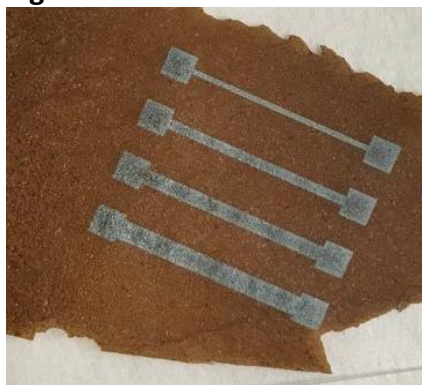
However, printing on delicate materials such as artificial skin presents many challenges, especially when a common desktop printer is used. To print on these materials, they must be dry, making them fragile and brittle. Due to this, some of the inside components of the desktop printer, like the rollers and wheels for dragging the paper can easily damage and eventually break them apart.

This work presents the comparison, advantages, and disadvantages of printing on the mussel-inspired membrane using a Dimatix (Fujifilms DMP 2800 series) research grade printer and an Epson XP-15000 desktop printer. As a case study, the resistivity obtained from the inks has been compared and its possible application for the construction of RF antennas as well as for a temperature sensor on the skin.

## References

- [1] MacNeil, S. *Nature* 2007, 445, 874-880.
- [2] Rahmati, M. et al. *Mater. Today Adv.* 2020, 5, 100051.
- [3] Ruiz-Molina, D. et al. *Angew. Chem.* 2019, 58, 696-714
- [4] Ershad, F. et al, *Nat. Commun.* 2020, 11, 3823.

## Figures



**Figure 1:** Silver tracks printed with Epson printer on the mussel-inspired free-standing membrane

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