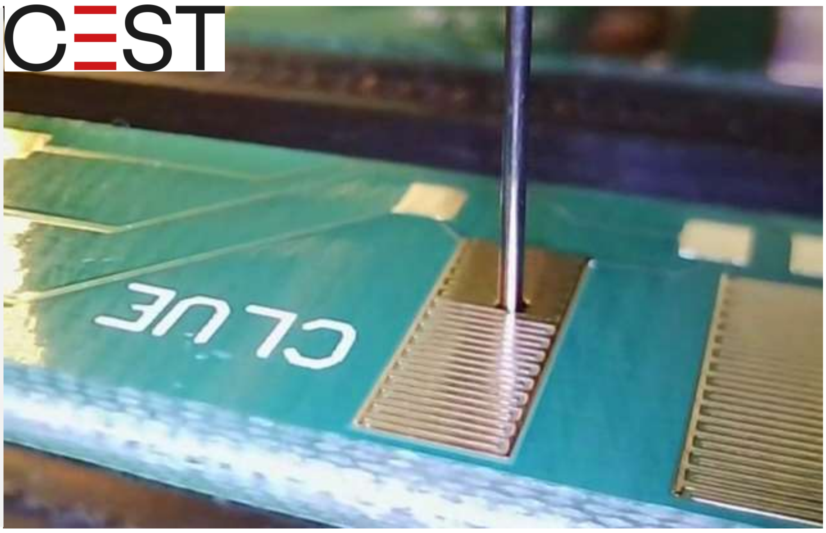
**SUCCESS STORY**

**Optimized production of ultra-thin organic films: fitting the key piece into the puzzle**

CEST – Center for Electrochemical Surface Technology

COMET-Centre

Funded non-K project: optimized application of conductive polymers [01/2021 – 03/2024]



Reproducible surface coating via meniscus-assisted printing. ©CEST

# OPTIMIZED PRODUCTION OF ULTRA-THIN ORGANIC FILMS: FITTING THE KEY PIECE INTO THE PUZZLE

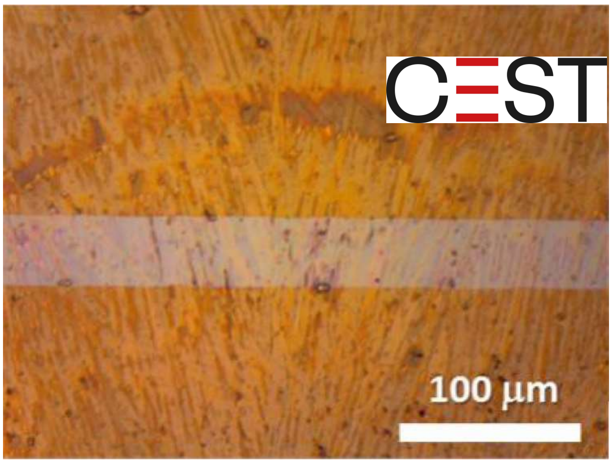
## ORGANIC THIN-FILMS ARE ESSENTIAL IN ELECTRONIC DEVICES AND THEIR FABRICATION PROCESS CAN BE TAILORED BY MENISCUS-ASSISTED PRINTING.

Organic electronic materials have started to rapidly enter our daily live with their implementation in smartphones, computer/tablets and smart home devices. Additionally, they bear huge potential to be used in optoelectronic and sensing applications in the close future. Although they are well researched, their industrial processing is still very challenging in terms of reproducibility, especially when creating very thin layers. At this scale, effects like the (random) crystallization of the used material or the occurrence of “coffee-ring” structures due to uncontrollable evaporation of the used solvents are difficult to control and highly influence the quality of the final products. With the introduction and optimization of a technique called meniscus-assisted printing, we were recently able to strongly improve the fabrication of these films, including the possibility to control the crystallization of the material in the desired direction.

The technique itself is comparable simple, since basically a pressure is applied to generate a meniscus, which allows a defined casting of the corresponding organic materials in solution onto a surface. The complexity of the system comes with the wide range of different materials and the related processing parameters like printing pressure, printing speed, height of the printing needle, the process temperature, the used solvent and curing time.

We successfully optimized the whole process for the specific use case of (bio-)sensors, where different conductive polymers were coated to a blank sensing platform. Depending on the polymer type, different molecules can be detected such as e.g. volatile organic compounds and the optimized surfaces/devices therefore used as sensor for the routine detection of biomarkers for diseases.

This new approach was further demonstrated to be suitable for the fabrication of surfaces with defined crystallinity, which means that the crystals are growing and oriented in a defined direction. This allows an overlapping and better conductivity in a specific direction and therefore provides the possibility for a fine tuning of the generated surface properties.




Detailed surface structure obtained with the meniscus guided printing process. The darker lines oriented from bottom to top demonstrate the ordered crystallinity of the film. ©CEST

In practice, the different organic subclasses such as conductive polymers, organic semiconductors, plastic thin films or printed electronics are all capable to be applied with the developed approach for basically any application.

**Impact and effects**

Organic electronic materials are highly interesting for industrial applications, since they are simple and can be integrated in low-cost manufacturing processes and therefore enable the fabrication of e.g. large-area flexible electronics. Although the optimized use case with conductive polymers for sensing applications is comparable specific, this new technique bears huge potential to be tailored for all related applications.

Based on this, an easier and more reproducible fabrication of electronic devices can be realized and minimize process scrap while improving the reliability and scalability.

**Project coordination (Story)**
Dr. Philipp Fruhmann
Senior Researcher
CEST

T +43 (0) 676 5721479
philipp.fruhmann@cest.at

**CEST**
Viktor Kaplan-Straße 2
2700 Wiener Neustadt
T +43 (0) 2622 22266 – 0
office@cest.at
www.cest.at

**Project partner**

- University of Cagliari, Italy
- AIT, Austria

This success story was provided by the consortium leader/centre management and by the mentioned project partners for the purpose of being published on the FFG website. Further information on COMET: www.ffg.at/comet