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Printed and flexible electronics research at VTT

Focus on printing processes for organic photovoltaics and transistors

Dr. Marja Vilkmán (VTT – Finland)

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Place: Anfiteatro Ed. UNINOVA

Livestream: <https://youtu.be/nqAmqz4rv4c>

Organic photovoltaics (OPVs) and organic thin film transistors (OTFTs) are essential elements in printed electronics applications. After a short introduction to VTT's printed and flexible electronics research, I will present our latest results with OPV and OTFT applications and show how the processes can be transferred to a roll-to-roll (R2R) environment. There is a selection of printing or coating methods that can be used in their production – each having their own benefits and drawbacks. In this presentation, I will focus on the use of gravure and screen printing and describe their special advantages and requirements. In addition, I will show how plasma treatment, direct etching, lift-off and self-alignment can be transferred into a continuous R2R line and utilised in the OPV and OTFT processes.

In addition to the active materials in printed electronics, electrodes are an important part of flexible electronic systems. Thus, I will dedicate part of my presentation for electrodes. They can be thin or thick, narrow or wide, transparent or visible – depending on the application. Several methods have been used for electrode manufacturing, the most obvious being direct printing of conducting inks. I will present also other production methods to produce flexible electrodes. In all cases, the processes have been chosen based on their suitability for roll-to-roll (R2R) production. This means that the process has to be suitable for flexible substrates and the process temperatures can't exceed 140 °C in order to be able to use standard substrates. In addition, the curing time has to be compatible with R2R production where the heating time is limited by the length of the ovens and process speed.

References:

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2. Välimäki, M., et al., R2R-printed inverted OPV modules – towards arbitrary patterned designs, *Nanoscale*, 7 (2015) 9570-9580.
3. Vilkmán, M et al., "Gravure-Printed ZnO in Fully Roll-to-Roll Printed Inverted Organic Solar Cells: Optimization of Adhesion and Performance", *Energy Technology* (Printed Energy Technologies special issue), 3 (2015) 407-413.
4. Vilkmán, M., et al., "Fully roll-to-roll processed organic top gate transistors using a printable etchant for bottom electrode patterning", *Organic Electronics*, 20 (2015) 8-14.

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