

# Roll-to-Roll PVD Coating System for Flexible Glass for Applications in the Field of Flexible Electronics and Others

## Review of one year of experience

Dr. Andreas Nilsson, Tina Dietsch, Carsten Deus

VON ARDENNE GmbH

Am Hahnweg 8

D-01328 Dresden

Germany

### PVD TOOLS FOR FLEXIBLE ELECTRONICS AND OTHERS

The manufacturing of flexible and organic electronics or optoelectronic devices imposes very specific requirements, which need to be addressed by dedicated coating tools. Ultra-thin flexible glass, one of the most exciting substrate innovations in the past years, has attracted considerable interest in various fields of application, such as flexible electronics, flexible OLED and flexible photovoltaics.

In the beginning of 2016, VON ARDENNE has installed a roll-to-roll (R2R) PVD coater in Dresden, the FOSA LabX 330 Glass. It was designed and optimized for the handling flexible glass, with a modular winding system and PVD process stations, to prove the feasibility of R2R processing of flexible glass substrates for a variety of applications.

The talk will summarize 12 months of operating the R2R coater. Furthermore, the results of process and layer stack developments will be presented focusing on the experience gained from handling flexible glass.

Flexible substrate winding system solutions designed and optimized for sensitive substrates such as barrier films or flexible glass, low-energy-impact sputtering solutions for transparent electrode layers and mirror coatings will also be discussed.

### R2R PROCESSING OF FLEXIBLE GLASS

Flexible glass is a substrate with a unique combination of properties that are, in different aspects, ideal for numerous applications. The material has stimulated significant interest in topics such as flexible electronics, flexible OLED, flexible PV. The key prerequisite for a widespread industrial adoption of R2R processing of flexible glass substrates is the availability of suitable and proven manufacturing equipment. The tools need to be able to handle and process this delicate material, taking into account its mechanical properties, which differ significantly from the typical flexible substrates such as paper, polymer film, or metal foil.

Over the last 12 months, VON ARDENNE has shown that flexible glass as a substrate can be handled and processed in a R2R PVD coater with high production stability even at elevated temperatures of 350 °C. The coater has been operated during a routine development use for more than 12 months for various applications. Sputtered layer stacks (ITO for OLED, AR, mirrors, ITO for touch) have been demonstrated, with qualities superior to state-of-the-art coatings on classical flexible substrates. The R2R processing of flexible glass has been demonstrated to be a feasible technology that opens new perspectives for the processing of advanced flexible devices.

The talk will discuss specific equipment aspects that need to be considered for the R2R handling of flexible glass, both in general and by taking the example of a roll-to-roll lab coating system, which has been designed specifically for handling flexible glass.

Furthermore, it will be shown how different processes such as R2R sputtering can be used for potential flexible glass applications in flexible electronics, architecture, and energy conversion devices. Beyond that, related layer stacks deposited by vacuum coating will be discussed.

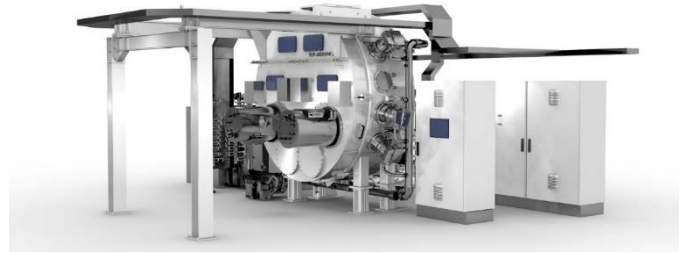


FIGURE 1. VON ARDENNE's FOSA LabX 330 Glass