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FRAUNHOFER INSTITUTE FOR ORGANIC ELECTRONICS, ELECTRON BEAM AND PLASMA TECHNOLOGY FEP

1 Process station with in-line FLA module

2 Pilot-scale in-line coater ILA 900 for sheet-to-sheet PVD processes

REFINEMENT OF THIN-FILMS BY IN-LINE FLASH LAMP ANNEALING

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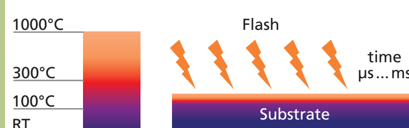
Flash Lamp Annealing (FLA) process

- Annealing of thin-films with high energetic Xe light flashes in a time range of milliseconds by discharging a high voltage capacitor bank over the Xe-lamp
- Main process parameters are energy density, pulse duration time, repetition rate, substrate speed
- Pulse times are in the range of some microseconds up to some milliseconds
- Energy densities are in the range of 5 to 40 J/cm²
- In-line process, suitable for substrate sizes up to 1200 mm × 600 mm

3 Temperature profile for heat impact on surfaces by using FLA

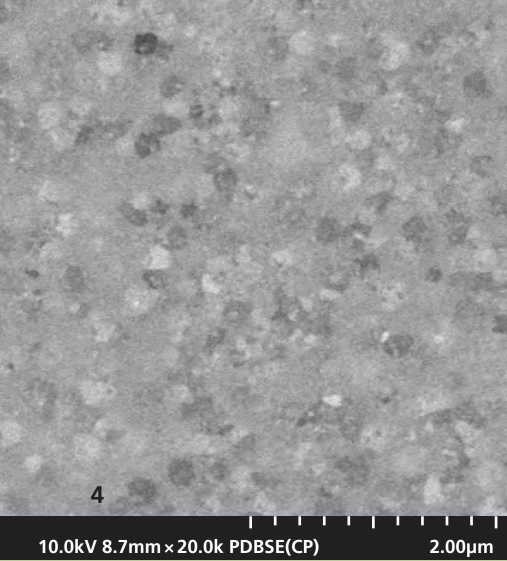


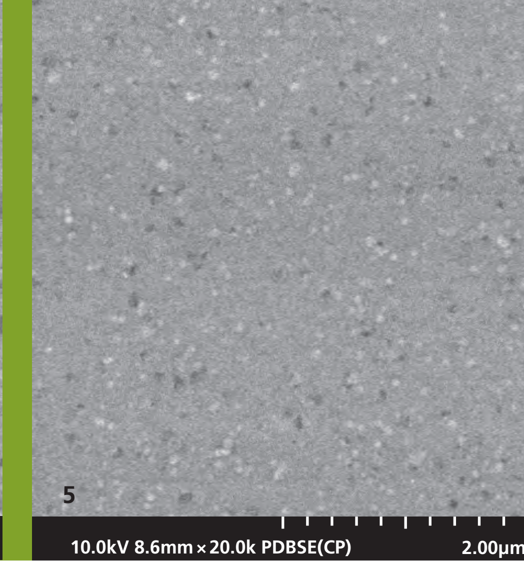
Application samples

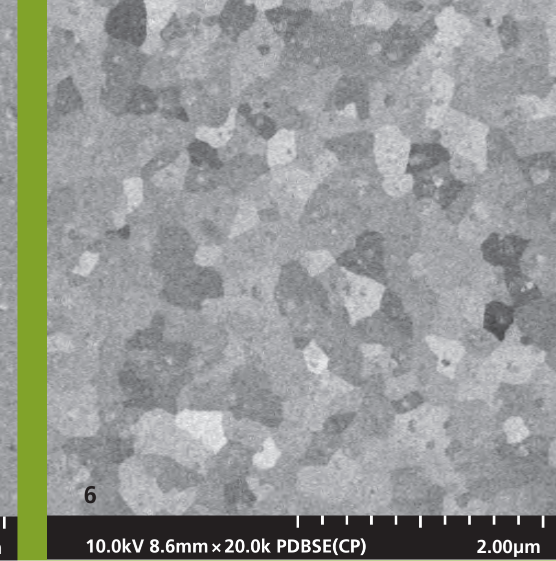
- Transparent conductive oxides (ITO, IZO, ZnO:Al, …)
- Optical thin-films (e. g. TiO_2)
- (Re-)Crystallization of thin-films
- Thin film electronics (e. g. displays, photovoltaic, pn junctions, TFTs, TTFTs)
- Printable electronics (with temperature sensitive substrates)
- Printed circuits

Advantages

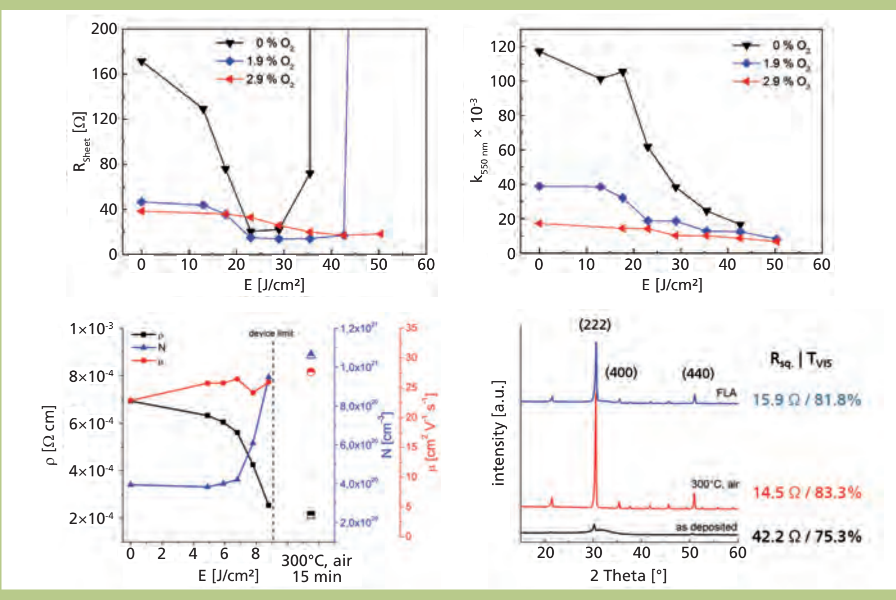
- Only surface is heated, the substrate remains cold
- Short process times in the millisecond time range
- No cooling down time
- Suitable for in-line processes and R2R processing



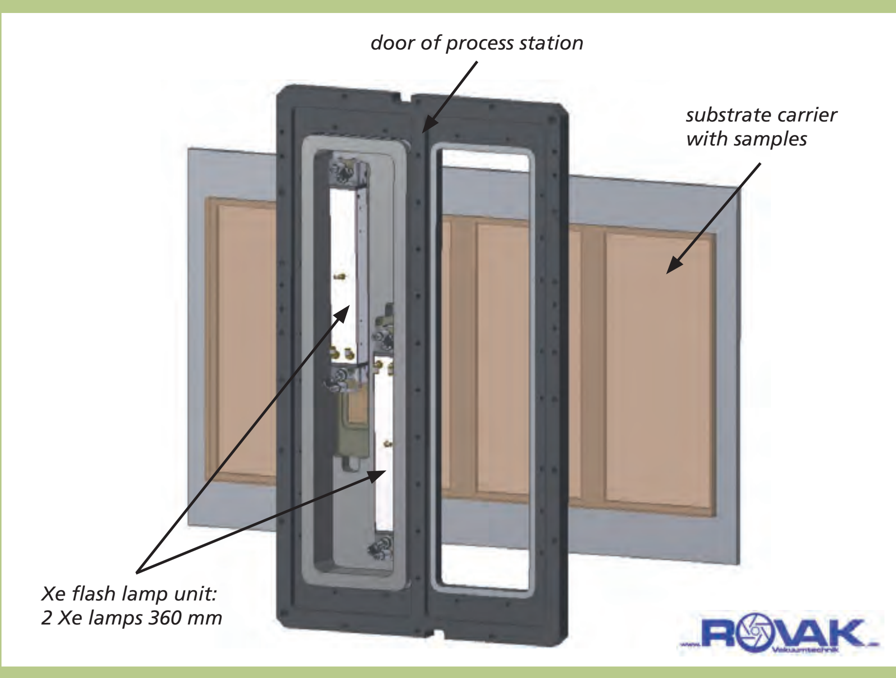




7 Properties of ITO thin-film



8 Arrangement of an in-line FLA module



Example annealing of ITO by FLA

- 150 nm thick ITO thin-films on low iron glass
- Investigation of influence additional oxygen during sputtering process
- Annealing with FLA at a pulse duration time of 10 ms

Our offer

- Research and development of thin-film processes with annealing by FLA
- Sampling, feasibility studies
- Annealing of small series
- Development of FLA processes for functional thin-films or thin-film stacks under pilot-scale process conditions
- Preparation of concepts, technology transfer and process integration

SEM images of 150 nm thick ITO thin-films

4 after coating, without any annealing, R_{sheet} 43 Ω

5 after annealing with FLA, pulse duration time 2 ms, discharge voltage 3700 V, R_{sheet} 16 Ω

6 ITO thin-film annealed after coating at 350°C in vacuum (standard procedure), R_{sheet} 14 Ω

We focus on quality and the ISO 9001.