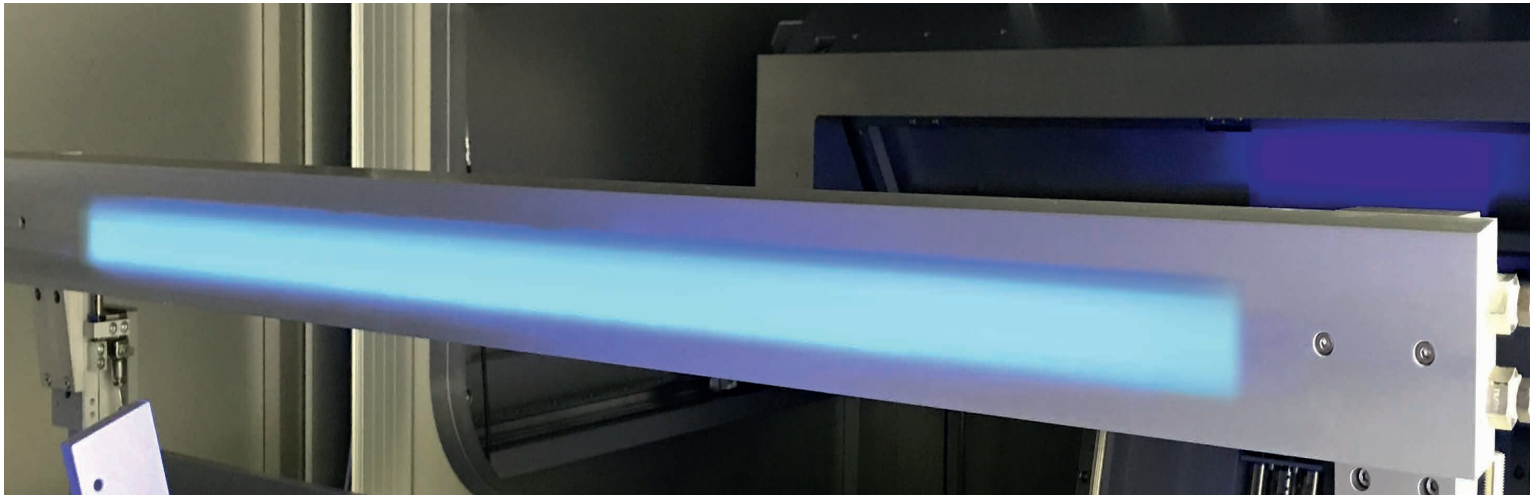


## UV Solid State Laser Annealing



UV Line Beam on beam dump

# UV Solid State Laser Annealing using VOLCANO LINE BEAM Optics

## Superior p-Si Film Quality for OLED TFT Back Plates

INNOVAVENT demonstrated in the application lab, that smooth and periodical grain structures are obtained in a 50-70nm a-Si film with the 343nm pulsed Line Beam. The periodical grain structure is mandatory in the manufacturing of Thin Film Transistors (TFT) for high resolution AMOLED displays.

The UV SLA (Solid state Laser Annealing) process was done with a VOLCANO LB 100UVC-4 Laser Optics powered by four TM 8320\* (20mJ, 10 kHz). A 100mm long line with a short axis FLATTOP profile of ~65µm (FW 90%) was scanned at 20mm/s. The energy density process window was 210-230mJ/cm<sup>2</sup>.

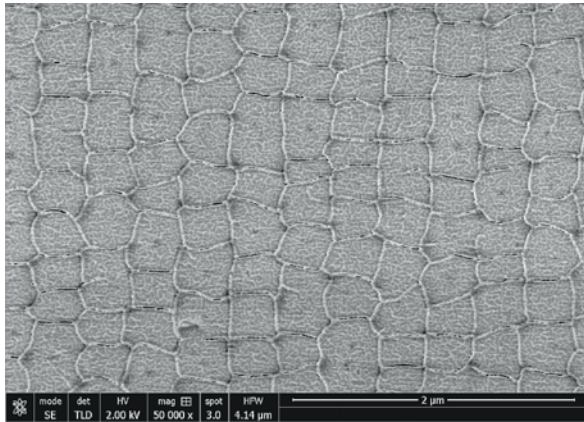


Fig. 1: Periodical (~350nm) and smooth p-Si grain structure in a 50nm Si-film obtained at 220mJ/cm<sup>2</sup>, 45ns FWHM, pitch 2,0µm (20mm/s @ 10kHz) with a 343nm FLATTOP Line Beam (scanning direction vertical)

The VOLCANO LB 100UVC-4 system includes the new features of preparing a steep (~10µm 90/10%) FLATTOP profile (patent pending) with a large DoF of 200µm, 175Hz long axis (+-1mm) µsmoothing, a time controlled polarization (patent pending) and temporal pulse shape setting. Furthermore the long axis angular energy distribution is set up to obtain an efficient laser induced periodical pattern structure (LIPPS). The lab set up at INNOVAVENT includes a processing chamber which prepares the substrate annealing atmosphere to less than 20ppm oxygen.

### VOLCANO LB 100UVC-4 Laser Optics

The VOLCANO® Line Beam is designed for a line length of 100-380mm. The use of solid state lasers emitting UV light at 343nm reduces the operating costs and increases the uptime of production tools remarkably, compared to ELA systems using excimer lasers.

The LB systems are based on a rigid aluminum housing structure and the FALCON projection lens gives a working distance of >200mm. Line Beam Optics include a MBC (Manual Beam Control) camera system which allows to control and adjust position and angle of all laser emitted beams. The FALCON XL

design contains one or two windows which seal the optics from the process chamber and protect against contaminations from the process.

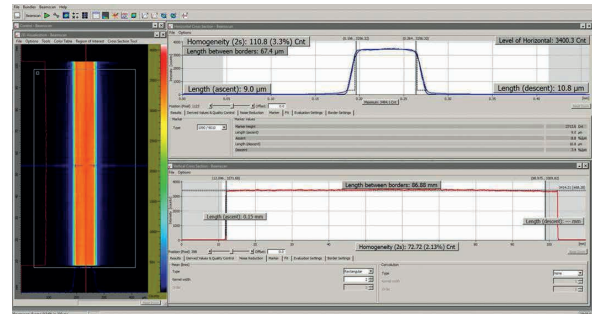


Fig. 2: False color and short axis FLATTOP profile of the 100mm long line

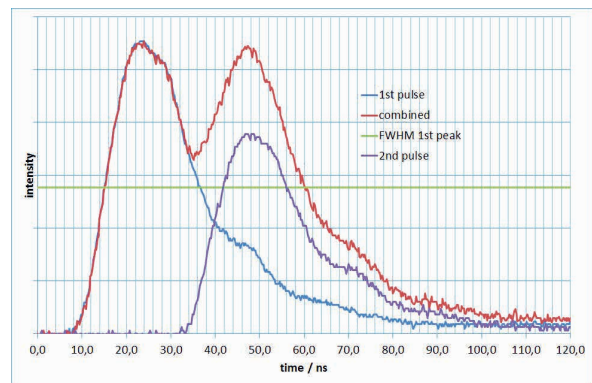


Fig. 3: Temporal pulse shape, FWHM first peak ~45ns

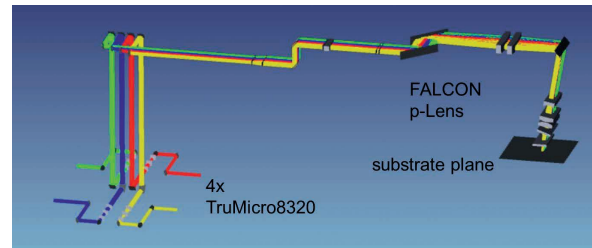


Fig. 4: VOLCANO LB 100UVC-4

### Line Length Options and System Configurations

Large FALCON XL and XXL projection lens configurations are available for a line length of up to 750mm.

Four TM 8320\* (20mJ, 10 kHz) lasers prepare the required energy density of 250mJ/cm<sup>2</sup> in a 380mm x 50µm FLATTOP line beam, four TM 8340\* (40mJ, 10 kHz) provide a line length of 750mm.

Long axis uniformity, 2 sigma	1,0-1,5%
FLATTOP uniformity, 2 sigma	2,0-3,0%
DoF, 5% ED change	200µm
Temp. pulse shape FWHM	~45ns FWHM
µsmoothing	175/+-1 Hz, +/-1mm

\* Tru Micro laser products from Trumpf Lasertechnik, Germany

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