Thin flex glass (TFG) workshop

14.05.14

Ultrafast laser processing of thin film interconnections in microelectronic, display, and photovoltaic applications

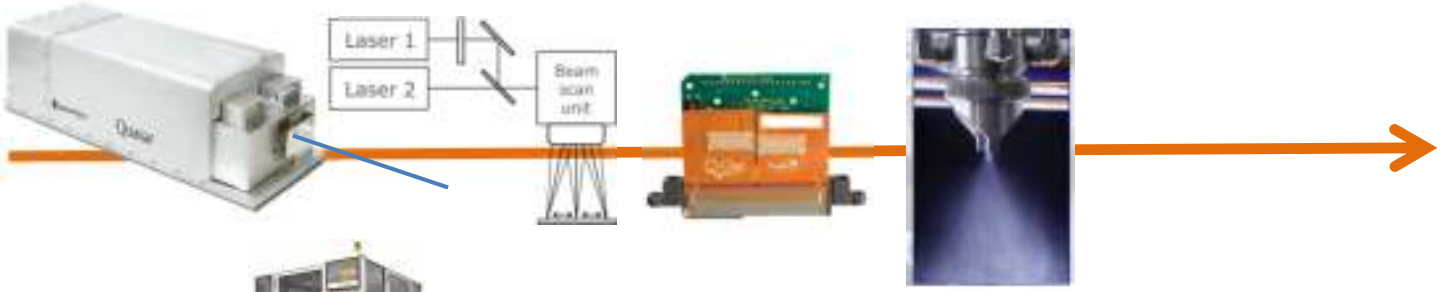
- Housekeeping
  - Toilets
  - Evacuation
  - Smoking
- Meeting agenda
  - Presentations
  - Posters
  - Demonstrations
  - Round up discussion
- Flexible Large Area Electronics (F-LAE)
  - Large Area Electronics processes
  - S2S LAE tools & applications
  - F-LAE roadmap
  - Thin Flex Glass

Evolution to F-LAE

Large Area Electronics (LAE)

Applications

Processes



Tools

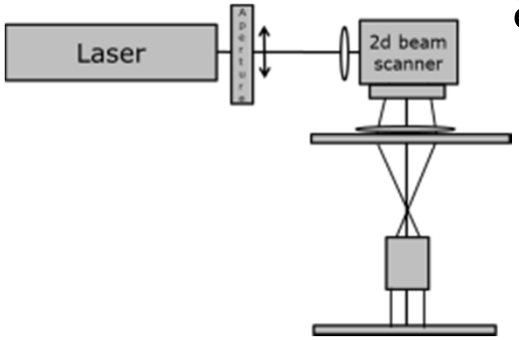
Substrates

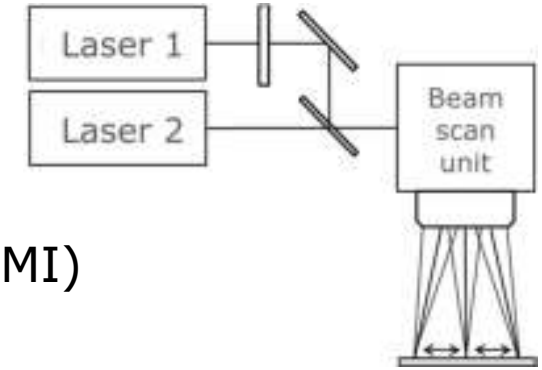
Flex Large Area Electronics (F-LAE)

Material additive & subtractive processes for LAE

- Additive processes
  - ink jet print
  - laser cure/expose
  - spray

- Subtractive laser ablation processes
  - Direct write
  - Aperture image
  - Scanned mask image (SMI)
  - Raster scan

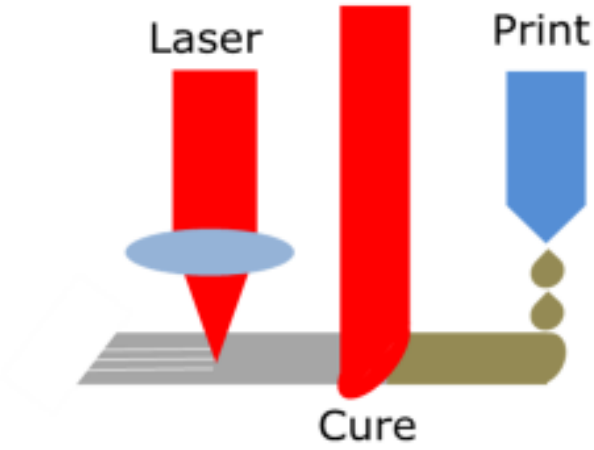




Our direct laser ablation processes replace conventional lithographic processes

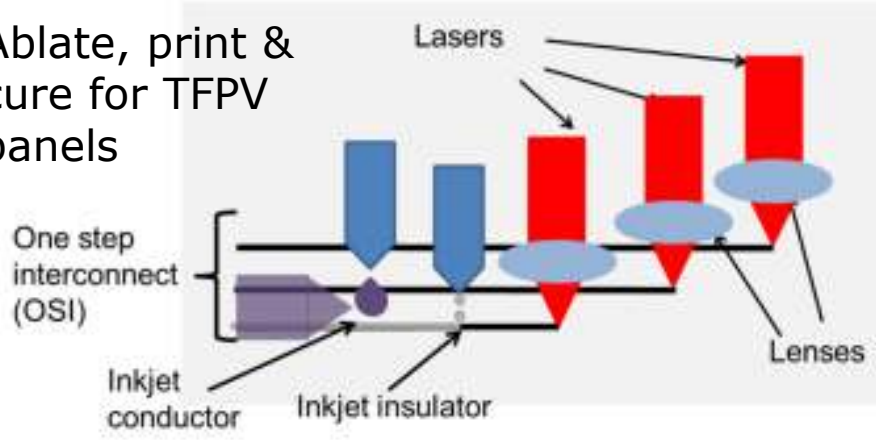
Our resolution limit is a few microns

Hybrid additive & subtractive processes to "*interconnect*" LAE devices



Print, cure & ablate for TP & SW busbars

Ablate, print & cure for TFPV panels

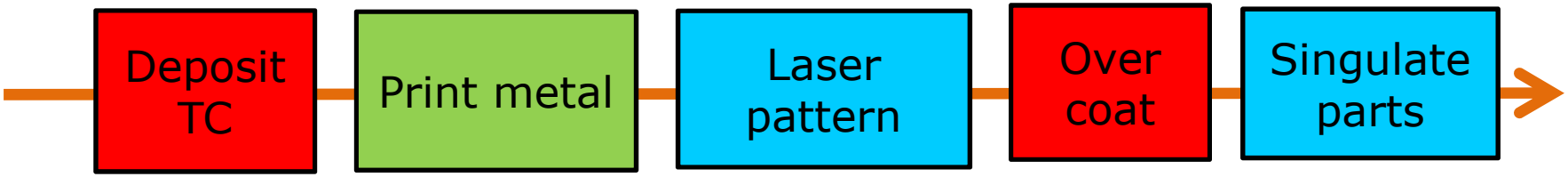


Other hybrid processes use lasers to modify surfaces to control printing

Other hybrid TP process require laser, print & spray steps

Our Flexible Large Area Electronics strategy

Develop a complete portfolio of R2R tools suitable for the manufacture of flexible "Large Area Electronics (F-LAE)" devices based on M-Solv additive, subtractive and hybrid processes

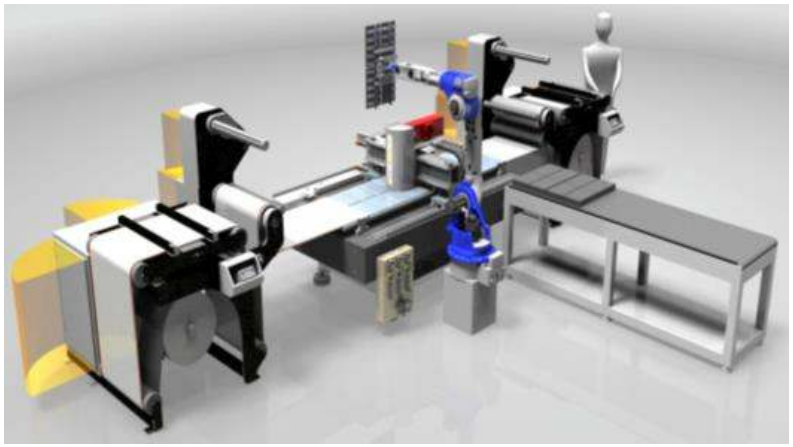


F-LAE R2R tools

"Batch Process" R2R tools
Web is stationary during process

MSV-6505 ITO/PET patterning tool

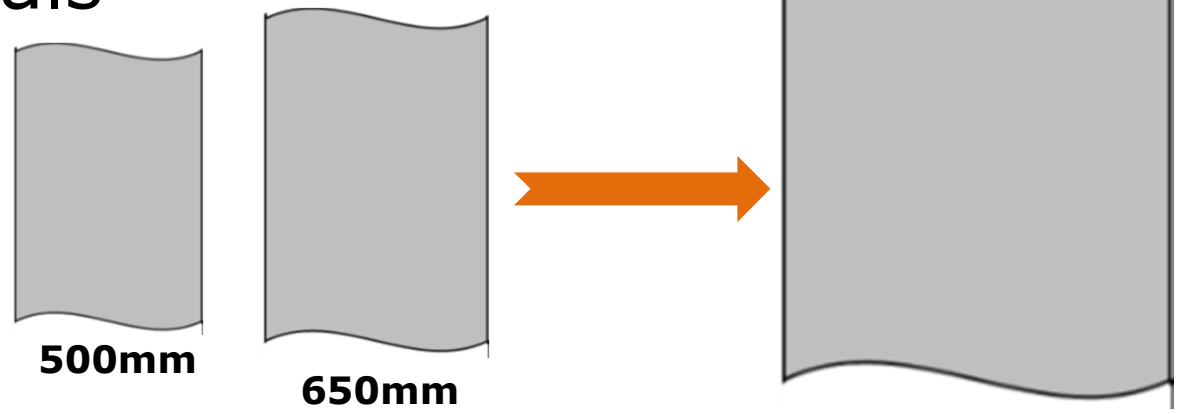
0.65m wide web



MSV-6501 ITO/PET cutting tool

F-LAE tool roadmap

- 3 standard R2R tools
- 3 maximum web widths
- 3 web materials
  - PET
  - SS
  - TFG



Gen 1 tools

500mm TFG & SS tools
650mm PET tools

1.3m TFG, PET & SS tools

Gen 2 tools

Thin Flex Glass (TFG)

- Why use TFG?
- **Applications**
- Sheets or spools?
- What TC coatings
- What processes?
- Transportation & handling?

Why use TFG?

- Barrier properties?
- Thermal properties?
- Optical properties?
- Mechanical properties?

Accessible R2R TFG applications

- OLED lighting
- Thin Film PV
- Smart windows
- PM LCDs
- LC signage
- Thin film batteries
- Large AM displays
- Sensors
- Capacitive touch panels
- 2.5 & 3D IC interposers
- ??

The primary objective of this workshop is to get a better understanding of where TFG will be used as a device substrate and where R2R mode processing is preferred

Key applications are for 2 and 2.5D devices where the barrier properties of TFG are critical

TFG on sheets or spools?

- High resolution device manufacturers wish to use TFG with their existing process tools
- These are all sheet (eg ≥G5) based
- No R2R TFG high resolution tools yet exist
- Hence TFG manufacturers are delivering in sheet form on glass carriers
  - Complex bond & de-bond processes required

We focus on TFG in spooled form since it:

- Matches our processes well
- Has lowest cost of ownership

TFG R2R pilot tool

Multi-function pilot R2R tool

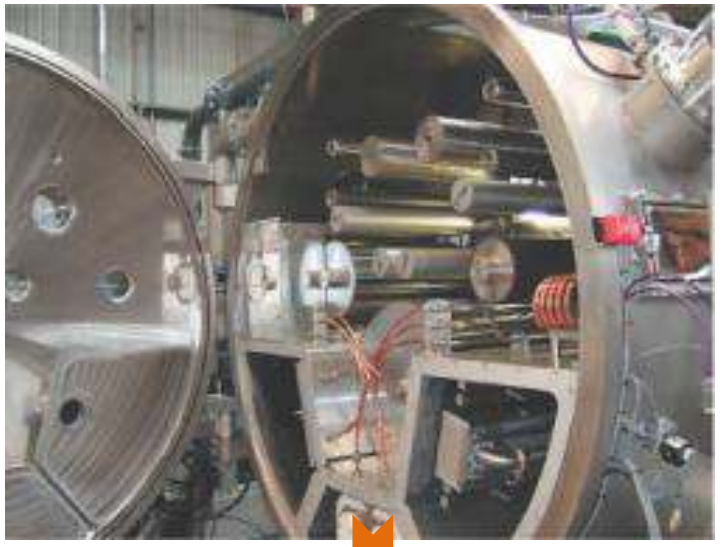
- Print
- Cure
- Pattern
- Cut

500mm wide TFG

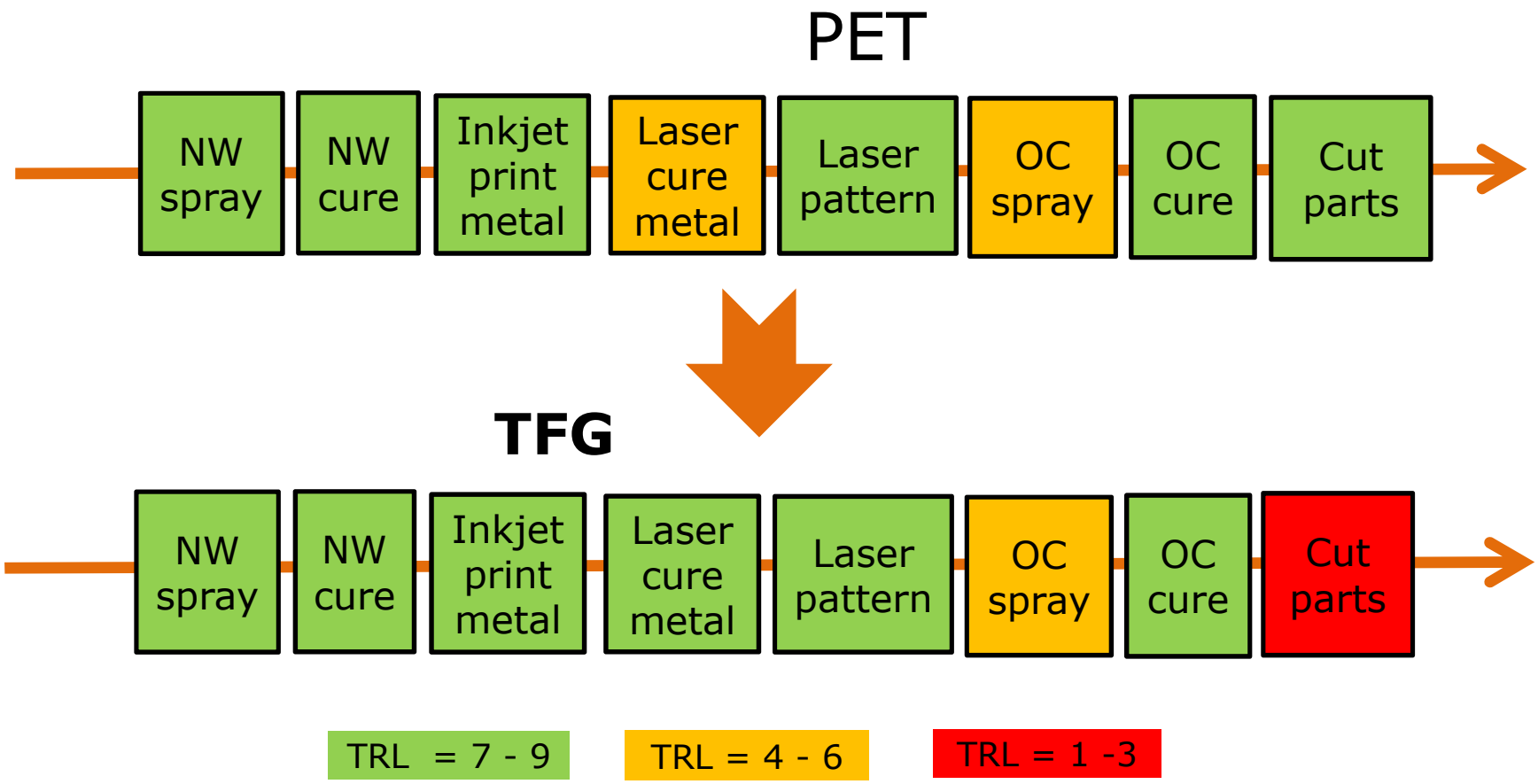
"Batch Process" R2R tool
Web is stationary during process

TC coatings on TFG

- Many TFG applications require a transparent conductive (TC) coating
- ITO is optimum but difficult to coat in R2R mode, is expensive and is not flexible
- We have developed a AgNW based TC
- We have fabricated advanced touch sensors on TFG with AgNW TC



TFG R2R process status



TFG R2R web handling status