PI-SCALE - a European flexible OLED pilot line

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Europe's technology leaders in the development of flexible organic light-emitting diodes (OLEDs) for lighting and signage applications have joined together in a consortium to develop an open access pilot line that will accelerate the commercial adoption of this promising new technology.

The project is supported by the European Commission, Horizon 2002 programme:

Call:	ICT-28b-2015
Topic:	Cross-cutting ICT KETs: Pilotline for OLEDS on flexible substrates
Type of action:	Innovation Action
Duration:	36 months (start Jan 1st, 2016)
Cordis webpage:	http://cordis.europa.eu/project/rcn/199175_en.html
Project website:	http://pi-scale.eu/

Project Objective:

"Bringing flexible organic electronics to pilot innovation scale" (PI-SCALE) is a highly needed response to bridge the gap which exists today between promising laboratory scale results of highly efficient flexible OLED modules and mass manufacturing of high value-added products. The project will integrate existing European infrastructures into a "European flexible OLED pilot line", which will operate in an open access mode and serve customers from along the value chain with individual product designs, validation of upscaling concepts, and system-level flexible OLED integration. The Consortium will connect the most advanced pilot line facilities with the best material providers and equipment manufacturers, creating a service that will offer substantial numbers of flexible OLEDs that can meet efficiency, durability and cost requirements of end users. Together with end-users for various markets, such as automotive and designer luminaires, PI-SCALE will demonstrate the capabilities of this pilot line doing process optimisation for product demonstrators to enable cost efficient production and facilitate an effective market introduction. In addition PI-SCALE will include a number of outreach activities to actively engage and educate interested users and suppliers for flexible OLEDs in interactive product concept development. PI-SCALE will not only support the market acceptance of flexible OLED products, but it will also ensure that prototype ideas from European companies will have the possibility of reaching a semi-industrial scale in a very short time.

The project partners are:
Coordinated by the Holst Centre, Netherlands
4 national Research and Development Centres:
CPI, UK; Fraunhofer FEP, Germany, Holst Centre, Netherlands and VTT, Finland.
Substrate developers:
DuPont Teijin Films, UK; FlexEnable, UK
Equipment developers:

Coatema Coating Machinery GmbH, Germany; M-Solv Ltd, UK
Outreach and organization:
Brabant Development Agency (BOM), Netherlands; AMIRES, Czech Rep.
4 embedded launching customers:
Audi AG, Germany; emdedesign GmbH, Germany; NSG Pilkington Ltd, UK; REHAU AG, Germany

PI-SCALE project will establish a sustainable industry around flexible OLEDs in Europe by increasing access to the technology and raise the awareness of the potential applications and opportunities of it. The created open access service will fabricate flexible OLEDS at pilot scale to bridge the gap between research and mass production. The services the pilot line will offer include the testing and scale up of new flexible OLED product ideas with customized designs. The testing of new materials, substrates and processes in the open access pilot facilities will also be undertaken, as well as the integration of flexible OLEDs into products and with other flexible electronics.

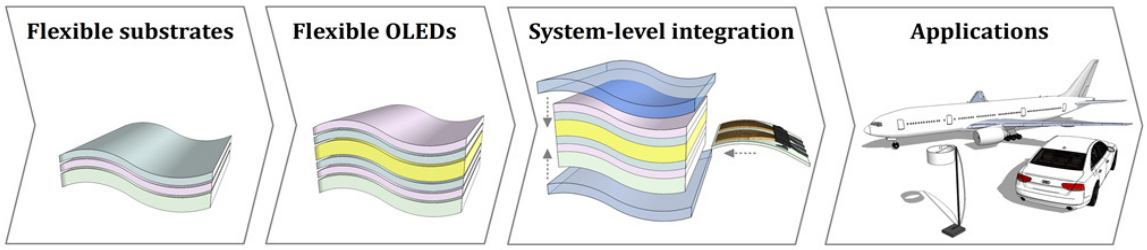

Figure 1: Schematic representation of the process steps in the PI-SCALE flexible OLED pilot line

PI-SCALE will engage and enable companies of all sizes to quickly and cost effectively test and scale up their flexible OLED lighting or signage concepts and bring them to a level where they are ready to be transferred to a mass production facility. The intention is that by increasing the availability of, and knowledge about, flexible OLED technology for companies that are interested in using it in their products, the pilot line will accelerate the commercial adoption of flexible OLEDs and help to build a sustainable industry in Europe around this technology. Open access means that any potential customer can use the pilot line services. It is not a 'closed shop', but instead an independent service where companies who are interested in creating flexible OLED lighting or signage products can work on their concepts in partnership with the best technology service providers in Europe, reducing the risks, cost and time needed for product development.

The pilot line includes all the steps required to turn OLED lighting concepts into advanced product prototypes. Specialist flexible substrates, moisture barrier and electrode films, and sheet-to-sheet and roll-to-roll OLED devices are all included, as well as all the system-level integration steps to incorporate the flexible OLED films and the other flexible electronics needed into a product form. The pilot line is a distributed at the 4 RTOs; Holst, FEP, CPI and VTT.

The pilot line will include R2R and S2S capabilities for the production of flexible OLEDs by solution and evaporative OLED material processing with the following form factors:

- Flexible OLEDS with efficacies of >50lm/W
- Customised flexible OLEDS in any colour or shape

- Flexible OLED rolls
- Flexible OLED strips
- Transparent flexible OLEDs

System level finishing integration will include:

- Laser finishing of devices
- Contact line printing
- Assembly and interconnection
- Addition of hybrid electronic components
- Lamination and bonding with other product layers
- Over-moulding to 3D polymer products

The components of the OLED structures within the project include:

- Specialist ultra-clean plastic substrates
- Rolls of moisture barrier film with WVTR 2-5x10^{-6} g/m^2/day (@ 20C/50%RH) and flexible anodes of <30Ω/sq
- Moisture barrier film and anode samples on glass carriers for sheet-to-sheet OLEDs with >10 years flexible lifetime
- Flexible TFT backplane with moisture barrier for smart lighting applications.
- Multilayer thin film top encapsulation for >20years OLED lifetimes.

PI-SCALE will initial serve the 4 launching customers, Audi, REHAU, Emdedesign and Pilkington, who will validate the pilot line service by using it to develop flexible OLED lighting products in the automotive, aeronautics and designer luminaire sectors. The pilot line is anticipated to offer further interested parties access some time during 2017, but the lead partners are already keen to discuss with other parties who have interests in using the pilot line services in the future.

The pilot line is positioned to bridge the gap between R&D and mass production and to offer small-to-medium scale pre-production runs of customised flexible OLED devices with a volume of up to 5000 m^2 of OLEDs/year. The pilot line enables parties to engage and to gain know how around the OLED technologies, test their concepts in up-scaled manufacturing processes, and have large numbers of product prototypes for application-specific operational testing (TRL7) as well as knowledge of the supply chain links to transfer the product they have developed using the pilot line to a mass production facility. The pilot line should allow faster development and trialling with reduced risks in this complex technology; reduce time from ideas to products with reduced risk.