Flexible, cost-effective and efficient LED lighting panels and solar cells

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The EU TREASORES project has created flexible lighting foils produced in a roll-to-roll method that could hold the potential for the large scale production of low-cost LED lighting panels and solar cells.

The project set out to find innovative solutions and develop new technologies to reduce the manufacturing costs of LED lighting panels, solar cells, and other organic electronic devices. Its most important contribution is the development and scaling up of manufacturing processes for new barrier materials and transparent electrodes that are used in advanced flexible optoelectronics.

Transparent electrodes to reduce cost and improve efficiency

Three electrodes-on-flexible substrates, using thin silver, metal fibers, or carbon nanotubes, are either anticipated to start production this year or are already being developed on a commercial scale. Tests were carried out on the new electrodes with different types of optoelectronic devices, using rolls measuring 100 metres in length. The use of such roll-to-roll (R2R) processing is comparable to the methods used for newspaper printing. The new electrodes produced through this method have demonstrated that they are suitable for complex solar cells and light sources.

Crucially the innovative processing methods hold the potential to make

solar cells and light sources less expensive in the future. This would bring benefits to consumers but would also facilitate the growth of more environmentally friendly lighting solutions, thus contributing to the European Union's ambitious climate change objectives.

The electrodes developed by the project are technically as good as the electrodes currently used by the lighting industry that are made indium tin oxide. However, they are cheaper to produce and do not depend on the use of indium. Importantly this does not compromise effectiveness, as the new electrodes are able support a stable light source over a wide area and attain an efficiency of 25 lumens/W. This is comparable to the relatively slower sheet-to-sheet manufacturing process used to produce similar devices.

Additionally, the project consortium also devised new techniques to ensure that the new electrodes are able to operate even when they are bent repeatedly, a test that has the potential to become an industry standard.

New novel transparent barrier foils

The project also had another exciting outcome – the testing, development and scale-up of new manufacturing methods to create transparent barrier foils. Low-cost and high-performance barriers were created that are now being further advanced and commercially developed by Swiss-based consortium partner Flexibles Kreuzlingen.

These types of barriers are required to maximise the lifetime and efficiency of the device, discovered by the project to be a crucial element when ensuring the economic and environmental viability of solar cells.

Overall, by integrating the production of electrodes and barriers, rather

than using two separate plastic substrates, the project has demonstrated that manufacturing costs for the production of such devices can be significantly reduced, as well as allowing for thinner and more flexible device designs.

Challenges and next steps

However, despite their great success, the project team has also faced the challenge of producing extremely flat, clean and smooth electrode and barrier foils. Optoelectronic devices feature active layers that measure several hundred nanometres, which means that even miniscule dust particles or slight surface irregularities can affect the device yield, or could result in a shorter lifetime and inconsistent, less effective illumination.

Even with the formal end of the TREASORES project in October 2015, the project partners have been continuing to address these challenges, preparing patents for the technology and moving towards full commercialisation of their novel devices. In total, the project received just over EUR 9 million in EU funding.

More information: For more information please see the TREASORES project website: treasores.eu/?page_id=18

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