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Coating under atmospheric and vacuum conditions – an innovative combination

Fraunhofer FEP is a leading provider for research and development services in the field of vacuum thin-film technologies. However, for a number of applications addressed by Fraunhofer FEP coating processes under normal pressure are as well of interest. Therefore Fraunhofer FEP expands its pilot plant park by another coating plant, which works under atmospheric conditions – the *atmoFlex*. The new plant concept will be presented by Fraunhofer FEP at the ICE 2015 for the first time.

In vacuum processes extremely thin functional layers are applied to surfaces. Mobile phones, computer monitors or the golden coffee packaging would be unthinkable without them. However, these layers are very sensitive due to their low thickness. A new research area, which was established at the Fraunhofer Institute for Organic Electronics, Electron Beam and Plasma Technology, examines this aspect among other things.

The scientists of Fraunhofer FEP see enormous potential in the combination of coatings produced by means of vacuum and atmospheric pressure processes. The sensitive vacuum coatings can be protected by thicker coating layers. The innovative idea is that high temperatures, which usually occur during varnish drying, will be replaced by alternative drying and cross-linking procedures. Therefore, Fraunhofer FEP relies on a new roll-to-roll plant for flexible substrates (plastic or metal film, thin glass), which uses electron beams under vacuum conditions for the crosslinking of varnishes and for surface treatment – the *atmoFlex*.

Dr. Steffen Günther, project manager, describes the advantages of the new plant concept: “The plant, which was designed specifically according to our requirements, will provide an electron beam system and the possibility for touchless slot-die-coating. The processing of substrates, which have already been vacuum-coated, will be considered specifically by this touchless varnish application process. The mechanical stress on the substrates will be minimized within the track due to the fact that all deflecting rollers are designed larger than in comparable plants. Beside the use of smoothing or stamping films will be possible due to special modifications in the track control concept. Thus extremely smooth surfaces or decorative films for furniture can be produced.”

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The company 3D-Micromac is currently developing the *atmoFlex*, which shall be put in operation at Fraunhofer FEP in 2015. The plant will be able to process substrates up to a width of 1250 mm and will offer a processing speed of up to 150 meters per minute. The modular construction of the plant will provide various possibilities to integrate technological add-ons and to investigate new processes in the future.

The scientists are looking forward to the new plant, which allows to make processes more efficient in order to provide a competitive advantage to their customers in the future. Fraunhofer FEP addresses various application fields with this new approach. On the one hand, the objective for durable and defect-free encapsulation of sensitive electronic components like OLED, organic and inorganic solar cells (CIGS, DSSC) will be pursued. On the other hand, innovatively structured layers will be realized, which will be used for high-value packaging. Further, layer developments for outdoor products will play a major role. The possibility for the modification of materials by electron beam irradiation will initiate new comprehensive developments.



Flexible OLED require encapsulation films which are effective and affordable at the same time in order to enable a long service life. The development of flexible OLED as well as the corresponding encapsulation solutions is one of the development focuses of Fraunhofer FEP. The *atmoFlex* plant is an important tool for the development of such encapsulations films.

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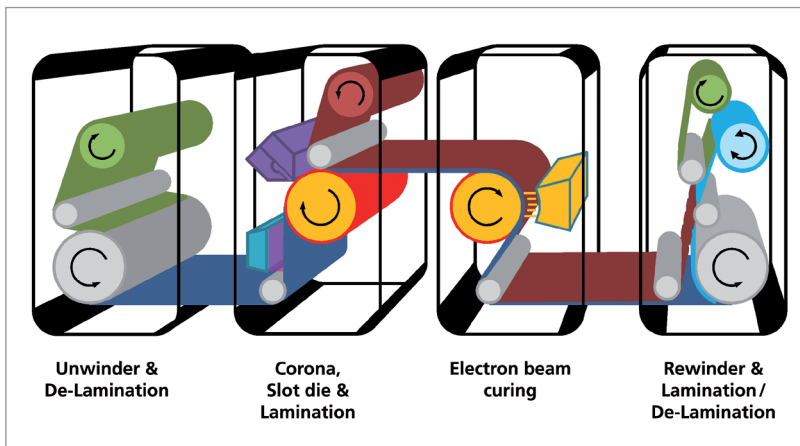
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Decorative and scratch protection films for furniture can be developed on the *atmoFlex* in the future.

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Schematic illustration of *atmoFlex*

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The **Fraunhofer Institute for Organic Electronics, Electron Beam and Plasma Technology FEP** works on innovative solutions in the fields of vacuum coating, surface treatment as well as organic semiconductors. The core competences electron-beam technology, sputtering and plasma-activated deposition, high-rate PECVD as well as technologies for the organic electronics and IC/system design provide a basis for these activities. Thus, Fraunhofer FEP offers a wide range of possibilities for research, development and pilot production, especially for the processing, sterilization, structuring and refining of surfaces as well as OLED microdisplays, organic and inorganic sensors, optical filters and flexible OLED lighting. Our aim is to seize the innovation potential of the electron beam, plasma technology and organic electronics for new production processes and devices and to make it available for our customers. COMEDD (Center for Organics, Materials and Electronic Devices Dresden) with all known activities in organic electronics is now acting as a new business unit at Fraunhofer FEP, Dresden, Germany.