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RESEARCH NEWS

New high-tech material

Milestone in graphene production

For the first time, it has been possible to produce functional OLED electrodes from graphene. The process was developed by Fraunhofer researchers together with partners from industry and research. The OLEDs can, for example, be integrated into touch displays, and the miracle material graphene promises many other applications for the future.

- Flexible OLED electrodes from graphene
- The perfect material: transparent, stable, flexible, conductive
- Ideal for touch screens, photovoltaic, wearables and much more

The Fraunhofer Institute for Organic Electronics, Electron Beam and Plasma Technology FEP from Dresden, together with partners, has succeeded for the first time in producing OLED electrodes from graphene. The electrodes have an area of 2 × 1 square centimeters. "This was a real breakthrough in research and integration of extremely demanding materials," says FEP's project leader Dr. Beatrice Beyer. The process was developed and optimized in the EU-funded project "Gladiator" (Graphene Layers: Production, Characterization and Integration) together with partners from industry and research.

Graphene is considered a new miracle material. The advantages of the carbon compound are impressive: graphene is light, transparent and extremely hard and has more tensile strength than steel. Moreover, it is flexible and extremely conductive for heat or electricity. Graphene consists of a single layer of carbon atoms which are assembled in a kind of honeycomb pattern. It is only 0.3 nanometers thick, which is about one hundred thousandth of a human hair. Graphene has a variety of applications – for example, as a touchscreen in smartphones.

Chemical reaction of copper, methane and hydrogen

The production of the OLED electrodes takes place in a vacuum. In a steel chamber, a wafer plate of high-purity copper is heated to about 800 degrees. The research team then supplies a mixture of methane and hydrogen and initiates a chemical reaction. The methane dissolves in the copper and forms carbon atoms, which spread on the surface. This process only takes a few minutes. After a cooling phase, a carrier polymer is placed on the graphene and the copper plate is etched away.

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Gladiator project was launched in November 2013. The Fraunhofer team is working on the next steps until the conclusion in April 2017. During the remainder of the project, impurities and defects which occur during the transfer of the wafer-thin graphene to another carrier material are to be minimized. The project is supported by the EU Commission with a total of 12.4 million euros. The Fraunhofer Institute's important industrial partners are the Spanish company Graphenea S.A., which is responsible for the production of the graphene electrodes, as well as the British Aixtron Ltd., which is responsible for the construction of the production CVD reactors.

Applications from photovoltaics to medicine

"The first products could already be launched in two to three years", says Beyer with confidence. Due to their flexibility, the graphene electrodes are ideal for touch screens. They do not break when the device drops to the ground. Instead of glass, one would use a transparent polymer film. Many other applications are also conceivable: in windows, the transparent graphene could regulate the light transmission or serve as an electrode in polarization filters. Graphene can also be used in photovoltaics, high-tech textiles and even in medicine.

Graphene and graphite

Anyone who thinks about graphite pencils when they hear graphite is not so far off. Graphite is also a carbon compound. However, the difference is that graphite consists of at least ten atomic layers, while graphene has only one.

Websites

- Gladiator project website: http://graphene-gladiator.eu/
- Fraunhofer Institute for Organic Electronics, Electron Beam and Plasma Technology FEP: http://www.fep.fraunhofer.de/en.html

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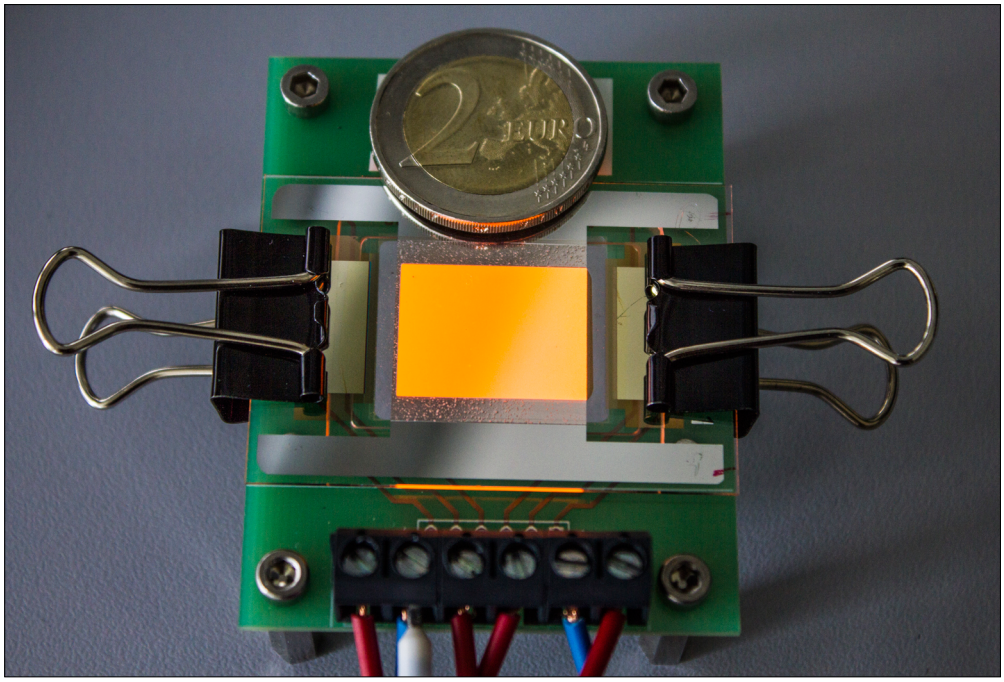

Orange luminous OLED on a graphene electrode. The two-euro coin serves as a comparison of sizes. © Fraunhofer FEP | Picture in color and printing quality: www.fraunhofer.de/en/press