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News Release

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NEMO Project: 11 Partners Conduct Research on New OLED Materials

- **German Federal Ministry of Education and Research (BMBF) is supporting the research project “New materials for OLEDs from solutions” (NEMO)**
- **Merck is leading the consortium of 11 partners**

Darmstadt, November 2, 2009 – Merck KGaA announced today that it has launched a project called "New materials for OLEDs from solutions" (NEMO) together with renowned partners from industry and science. The objective of this project, which is being co-funded by the German Federal Ministry of Education and Research, is to develop innovative, soluble materials for use in large-area organic light-emitting diode (OLED) components for devices such as televisions, electronic traffic signs or lighting systems. The total budget amounts to around €32 million.

“OLEDs have tremendous future potential as a cost- and energy-efficient lighting technology,” said Dr. Udo Heider, Vice President responsible for the OLED unit at Merck. “We want to provide industry with customized OLED materials, thus enabling cost-effective manufacturing processes from the liquid phase.”

The NEMO project, which is being funded until the end of July 2012, involves four industrial companies and seven academic partners. Merck, with its wealth of experience in the field of OLEDs and in other display technologies, is leading the consortium. The three other participating companies are H.C. Starck Clevis GmbH (Leverkusen), Ormecon GmbH (Amersbek near Hamburg) and DELO Industrie Klebstoffe GmbH & Co. KGaA (Windach near Munich). The Fraunhofer Institute for Applied Polymer Research (Potsdam) is taking part in NEMO as an independent research organization. The University of Tuebingen and the University of Regensburg

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are both represented with two chairs each. Further university partners are Humboldt University of Berlin and the University of Potsdam.

The costs of the NEMO project are expected to total € 31.8 million. Within the scope of the promotion program called "Material Innovations for Industry and Society," the BMBF is providing funding of € 16 million. The industrial companies will finance the remaining expenses on their own. The project is thus one of the flagship projects of the BMBF promotional initiative "Organic Light-Emitting Diodes – Phase II".

An OLED is a solid-state semiconductor device composed of thin films of organic molecules that create light when electrical current is applied. The main difference to inorganic light diodes (LEDs) is their lower current density and laminar light density and the fact that no crystalline materials are required. OLEDs are already being used in small-surface displays, for instances in cell phones and MP3 players. OLEDs emit light of different colors when electrical current is applied. They consume little energy and offer sharp images from every viewing angle. By using ultra-thin luminescent layers, OLED technology makes it possible to produce unique, large-surface homogeneous lighting surfaces with a total layer thickness of just a few millimeters. Compared to the vacuum evaporation process used today, these new materials should significantly improve scalability and coating efficiency in particular. To this end, the NEMO project partners are focusing on soluble phosphorescent materials for red, green and blue applications. In order to develop marketable solutions quickly, different injection, transport and electrode materials as well as adhesives are being researched, evaluated and tested in parallel for their performance.

NEMO – Who is doing what?

Along the multi-layer structure of solution based OLEDs on Indium-Tin-oxide-coated-glass the 11 partners are investigating (cathode layer / electron injection layer / emitter / charge injection layer) different topics.

Merck is developing and testing new emitting systems based on soluble small molecules. In this layer, electrical current is converted into light. H.C. Starck Clevis and Ormecon are developing materials with their own respective solutions for



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additional layers that will tremendously improve the efficiency of the components. Parallel to this, H.C. Starck Clevios is working on highly conductive polymer anode materials that could serve as an alternative to the indium-tin oxide layer, which is expensive and brittle. Ormecon is conducting research into alternatives to the light transmission from the emitter to the anode and is at the same time analyzing possible mechanisms responsible for the limited lifetime of OLEDs. DELO Industrie Klebstoffe is developing special adhesives to encapsulate the OLED components.

The Fraunhofer Institute is developing and testing emitting systems based on polymers (long-chain molecules), which Merck will subsequently test in the component. At the University of Tuebingen, the NEMO partners are working on new emitting systems made from metal cluster compounds. In Berlin, Humboldt University is pursuing modular synthesis strategies for new electron transport materials in the layer between the emitter and the cathode. The University of Regensburg is simulating new emitting materials and is also conducting photophysical studies on materials that are being developed within the scope of NEMO. And researchers at the University of Potsdam are studying physical properties such as charge carrier transport and dynamics.

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