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News Release

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Merck KGaA, Darmstadt, Germany, Presents Innovations at SID Display Week 2014

More than a quantum step forward toward the next generation of displays

- **Keynote speech by Michael Heckmeier: Synergies are accelerating the development of ultra-modern materials for LC and OLED applications, permitting a broad portfolio of future-oriented technologies – not only for displays**
- **Co-developed with industry partners: Ultra-Brightness FFS – up to 15% higher light transmittance – Customer-specific LC mixtures for nearly all display applications**
- **Quantum materials: Extended color range – Brilliant greens and reds – Higher brightness – Lower power consumption – Electrically controlled light emission**
- **Expansion of the isiphor[®] portfolio: Green phosphor achieves more intense colors and is distinguished by high energy efficiency in display backlights**

Darmstadt, Germany, May 28, 2014 – Merck KGaA, Darmstadt, Germany, will be presenting technologies for the next generation of displays at the SID Display Week in San Diego, CA (USA) from June 3 to 5. The latest developments by Merck KGaA, Darmstadt, Germany, the market and innovation leader, show that the company stands for "The Perfect Pixel". Michael Heckmeier, Senior Vice President, Liquid Crystals R&D at Merck KGaA, Darmstadt, Germany, will explain in his keynote speech how the products in the company's diverse portfolio optimally complement each other and are synergistically driving the development of ultra-modern materials. He will discuss how the company's resolute research work has influenced the entire display market: all the way to increasingly high-performance applications coupled with continually lower costs.

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Merck KGaA

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Under the brand name **licristal**[®] Merck KGaA, Darmstadt, Germany, is cooperating closely with the industry to develop liquid crystals for the next generation of displays. **Ultra-Brightness FFS** (UB-FFS) offers a future-oriented technology that is already being used in mass production. In conjunction with a corresponding panel design, innovative, energy-saving UB-FFS technology permits light transmittance that is up to 15% higher. The customer-specific liquid crystal mixtures supplied by Merck KGaA, Darmstadt, Germany, are suitable for nearly all display applications.

The innovative **Blue Phase** technology can shorten the time needed to manufacture LC displays since it does not require any orientation layers. At the same time, it offers switching times of less than one millisecond and superb contrast values with minimum viewing angle dependency.

The **Uniform Lying Helix** (ULH) LC technology is characterized by a fundamentally new switching mechanism based on flexo-electrical properties of innovative liquid crystals. Consequently, ULH is capable of optimizing the transmission, switching times and angle viewing dependency of display applications.

With **licrivue**[®] Merck KGaA, Darmstadt, Germany, offers reactive mesogens for 3D Film-Patterned Retarders (3D-FPR), which are used in 3D displays. The licrivue[®] range also includes reactive mesogen mixtures (RMM) to manufacture IPS/FFS compensation films. Negative dispersion RMM (ND-RMM) for achromatic $\lambda/4$ films (AQWF) improve the properties of LCD and OLED displays.

Quantum materials are a further highlight among the innovations presented by Merck KGaA, Darmstadt, Germany,. The nanocrystals co-developed with Qlight Nanotech absorb short wavelength incident light and emit light at a longer wavelength. The emission wavelength can be tuned by the nanoparticle size. Quantum nanomaterials offer an expanded color range featuring stronger and more natural greens and reds. Rod-shaped quantum materials offer a color conversion mechanism and extended color gamut similar



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to that of spherical quantum nanoparticles. However, their ability to emit polarized light is unique. Thus, they achieve a remarkable increase in brightness and a drastic reduction in power consumption. With light emission controllable by electrical fields, quantum rods optimize the color spectrum, luminosity as well as power consumption of liquid crystal displays, thereby creating entirely new display possibilities.

The **isiphor**[®] brand stands for tailor-made, state-of-the-art LED ideas and solutions. It offers energy-efficient, high-quality phosphors for LC display backlighting as well as for creative LED lighting applications. A special green phosphor that permits more intense and richer display colors is a new addition to the portfolio. Excellent long-term stability and the narrow light spectrum which results in higher efficiency in backlighting applications distinguishes this phosphor.

The **livilux**[®] portfolio includes the latest small molecules for evaporation processes as well as soluble material systems for printing processes, covering the full range of OLED applications. The high-purity electron transport, hole transport and matrix materials are highly efficient and long-lasting.

Under the **lisicon**[®] brand, Merck KGaA, Darmstadt, Germany, offers customer-specific and printable formulations for organic thin film transistors (OTFT), organic photovoltaics (OPV) and organic photodetectors (OPD). Organic semiconductors, dielectrics and materials for surface treatment are used in flexible displays and OLED applications.

Liquid crystal specialist Merck KGaA, Darmstadt, Germany, has developed a new LC technology for the production of **switchable windows**: Thanks to **Merck Smart Energy Glass Technology** (MSEGT) of Merck KGaA, Darmstadt, Germany, the smart windows can be switched in just seconds from light to dark and vice versa. Even continuously variable dimming is possible. Individually adaptable windows create new prospects for the architectural design of windows and facades. The liquid crystal technology used here is specifically optimized for longevity and temperature resistance and can be used in a wide variety of window and facade applications. Liquid crystals are thus setting new standards in user-friendly light, temperature and energy management.



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At the international symposium held during SID Display Week, Merck KGaA, Darmstadt, Germany, will be presenting its latest research and development successes in a keynote speech as well as in an informative lecture:

Materials Drive Display Development

Michael Heckmeier, Senior Vice President, Liquid Crystals R&D, Merck KGaA, Darmstadt, Germany

June 3, 2014 from 8:50 a.m. - 9:20 a.m., Room 6AB

High-Performance OLED Materials

Holger Heil, Director OLED Physics team, Merck KGaA, Darmstadt, Germany

June 5, 2014, 9:00 a.m. - 9:20 a.m., Room 1

All events will take place at the San Diego Convention Center.

Visitors to 2014 SID Display Week can find Merck KGaA, Darmstadt, Germany, at booth 911.

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About Merck KGaA, Darmstadt, Germany

Merck KGaA of Darmstadt, Germany, is a leading company for innovative and top-quality high-tech products in the pharmaceutical and chemical sectors. Its subsidiaries in Canada and the United States operate under the umbrella brand EMD. Around 38,000 employees work in 66 countries to improve the quality of life for patients, to further the success of customers and to help meet global challenges. The company generated total revenues of € 11.1 billion in 2013 with its four divisions: Biopharmaceuticals, Consumer Health, Performance Materials and Life Science Tools. Merck KGaA of Darmstadt, Germany is the world's oldest pharmaceutical and chemical company – since 1668, the name has stood for innovation, business success and responsible entrepreneurship. Holding an approximately 70 percent interest, the founding family remains the majority owner of the company to this day.