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HKUST Offers Brighter Future for Local Optoelectronics Industry

Researchers at the Hong Kong University of Science and Technology (HKUST) are developing new technology for the manufacture of high-brightness inorganic blue/green light-emitting diodes (LEDs) to help the local optoelectronics industry sharpen its edge in a fast-growing world market.

The three-year project has been awarded HK\$15 million by the Government's Innovation and Technology Fund, with a matching sponsorship of HK\$1.5 million by three local LED companies: COTCO, Lighthouse Technology Limited and Strong Base Investment Ltd.

The project is also supported by an equipment grant from the German company AIXTRON AG, the world's leading supplier of Metalorganic Chemical Vapor Deposition (MOCVD) equipment. HKUST purchased at reduced price an AIX 2000 HT reactor with a capacity of six two-inch wafers. MOCVD systems are essential for the production of reliable, large-quantity and highly efficient LED structures. AIXTRON will also collaborate with HKUST on technology transfer for the system application. Another sponsor, EpiChem, Inc, a US/UK company, is providing support in the form of high-purity metalorganics needed for the MOCVD process.

LEDs are semiconductor devices that emit colored lights. They have the advantages of small size, high brightness, low power consumption, longer lifetime, greater reliability and flexibility in designing new lighting applications. They have been used to replace conventional incandescent traffic lights and color light bulbs for special applications. Their high brightness makes them ideal for applications in large-area display panels (eg, outdoor video screens), traffic lights and signages as well as backlighting for consumer electronics products (eg, mobile phones and electronic games).

One of the most outstanding LED displays is the Nasdaq MarketSite Tower in New York's Time Square, which is the largest video screen in the world and contains almost 19 million high-brightness LEDs. In Hong Kong, the video screen at Times Square in Causeway Bay and display panels in MTR compartments are all LED applications. Currently, the production cost of some new colors such as blue, green, and white is relatively high but it is believed that mass production will reduce the costs substantially when the technology is better developed.

The project is designed to help local industry develop new products, nurture local talents and, ultimately, spawn new investment in the LED chip fabrication market. HKUST researchers will collaborate with international and local LED companies to investigate and develop technology for prototype production of inorganic LED structures that emit in the blue/green spectral regimes. These LEDs are made with compound semiconductors, materials with relatively high complexity that have found increasing use for photonic and high frequency device applications. As these LEDs are advanced models that are difficult to fabricate, they are always in high demand.

"Currently local LED companies have to rely on overseas suppliers for processed LED chips as Hong Kong lacks both the technology and infrastructure to develop its own inorganic LEDs," says project coordinator Prof Kei May Lau, an expert in compound semiconductor materials and devices. She joined the Electrical and Electronic Engineering Department last fall after an 18-year tenure on faculty at the University of Massachusetts, Amherst.

"Through the project, we will design, fabricate and test prototype LEDs before transferring the technology to industry. Local companies can in turn design their own devices for specific applications in terms of color, brightness and efficiency, to be integrated with their systems. All in all, they can produce LED products with unique features, lower cost

and greater flexibility," she says.

"Moreover, Hong Kong will also benefit from a pool of locally trained experts specializing in LED device design and processing," she adds.