Researchers develop selective transfer printing technology for microLEDs

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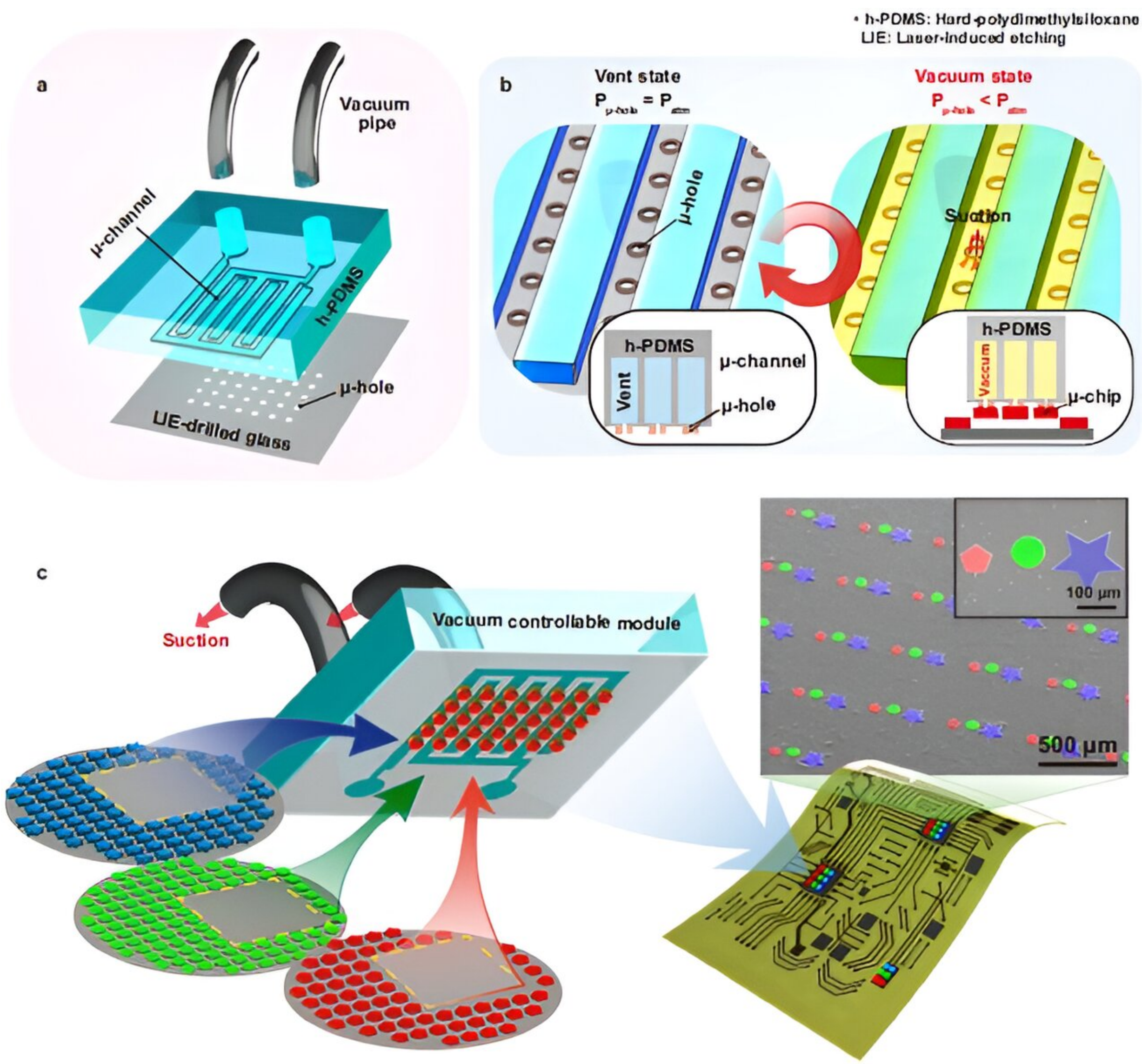

Concept of micro-vacuum assisted selective transfer printing (μVAST). Credit:

Nature Communications (2023). DOI: 10.1038/s41467-023-43342-8

A research team KAIST from led by Professor Keon Jae Lee has demonstrated the transfer printing of a large number of micro-sized inorganic semiconductor chips via the selective modulation of micro-vacuum force. The research, titled "Universal selective transfer printing via micro-vacuum force," is published in the journal *Nature Communications*.

MicroLEDs are a light source for next-generation displays that utilize inorganic LED chips with a size of less than 100 μm. MicroLEDs have attracted a great deal of attention due to their superior electrical/optical properties, reliability, and stability compared to conventional displays such as LCD, OLED, and QD.

To commercialize microLEDs, transfer printing technology is essential for rearranging microLED dies from a growth substrate onto the final substrate with a desired layout and precise alignment. However, previous transfer methods still have many challenges such as the need for additional adhesives, misalignment, low transfer yield, and chip damage.

Professor Lee's research team has developed a micro-vacuum assisted selective transfer printing (μVAST) technology to transfer a large number of microLED chips by adjusting the micro-vacuum suction force.

The key technology relies on a laser-induced etching (LIE) method for forming 20 μm-sized micro-hole arrays with a high aspect ratio on glass substrates at fabrication speed of up to 7,000 holes per second. The LIE-drilled glass is connected to the vacuum channels, controlling the micro-vacuum force at desired hole arrays to selectively pick up and release the microLEDs.

The micro-vacuum assisted transfer printing accomplishes a higher adhesion switchability compared to previous transfer methods, enabling the assembly of micro-sized semiconductors with various heterogeneous materials, sizes, shapes, and thicknesses onto arbitrary substrates with high transfer yields.

Professor Lee said, "The micro-vacuum assisted transfer provides an interesting tool for large-scale, selective integration of microscale high-performance inorganic semiconductors. Currently, we are investigating the transfer printing of commercial microLED chips with an ejector system for commercializing next-generation displays (Large screen TVs, flexible/stretchable devices) and wearable phototherapy patches."

More information: Sang Hyun Park et al, Universal selective transfer printing via micro-vacuum force, *Nature Communications* (2023). DOI: 10.1038/s41467-023-43342-8

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