

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](https://doi.org/10.1038/s41467-023-43342-8)

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