

## Stretchable Micro-Light Emitting Diode Arrays for Color Sensing Systems

*Shin Park<sup>1</sup>, Su Eon Lee<sup>1</sup>, Jun Hyun Park<sup>1</sup>, Young Chun Ko<sup>1</sup>, Hye Young Kim<sup>1</sup>, Sun Hee Lee<sup>1</sup>, Jun Pyo Hwang<sup>1</sup>,  
Seung Won Seon<sup>1</sup>, Tae Sang Yu<sup>1</sup>, and Bong Hoon Kim<sup>1</sup>*

<sup>1</sup>Dept. of Organic Materials and Fiber Engineering, Soongsil University, Seoul 06978, South Korea

Tel.: 82-2-820-0620, E-mail: [bonghoonkim@gmail.com](mailto:bonghoonkim@gmail.com)

The current technology development in inorganic micro-light emitting diodes (LEDs) has enabled high efficiency operation, low energy consumption, and long lifetimes, creating new possibilities in conventional display industry. Additionally, ultrathin device geometries and optimized mechanical designs with a transfer printing technique provide indicators and lighting modules integrated on stretchable substrates.

Here, we demonstrate a novel stretchable device with mechanically optimized layouts to achieve arrays of inorganic micro-LEDs and photodetectors (PDs) in systems that can perceive the color of an oncoming object. This device exploits co-integration of inorganic micro-LEDs and PDs in a stretchable format that provides both a source of light and an ability to measure backscatter from an approaching red object. Especially, the intensity of this backscatter can be correlated to the distance from the object and its color. The inorganic micro-PDs use reverse-biased GaAs diodes as functional detectors of light emitted from the inorganic micro-LEDs. A photographic image of the integrated system appears in Fig. 1. It shows this type of system, with 4 x 4 arrays of inorganic micro-LEDs and PDs, integrated onto the stretchable silicone elastomer substrate. As expected, the photocurrent measured at the inorganic micro-PDs increases monotonically with decreasing distance from the object, as shown in Fig. 1, for reverse bias voltages (-2.5V).

**Fig. 1. Stretchable optical color/proximity sensors consisting of an array of inorganic micro-LEDs and PDs integrated on the silicone elastomer substrate.**

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