제 92회
ORGAN ON A CHIP
기술교류회

한림대학교

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한림대학교 중개의과학연구원 포스터홀

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1. Education

박사: University of Illinois at Urbaba-Champaign (2006)
학사: 연세대학교 (2001)

2. Experience

2022 ~ 현재 KAIST 지정 석좌교수
2021 ~ 현재 KAIST 산학협력센터장
2016 ~ 현재 FRONICS Inc., CTO
2009 ~ 현재 KAIST 신소재공학과, 교수
2006 ~ 2008 Unistantis Electronics, Semiconductor Design Staff

제목

자가발전 유연소자: 압전 센서 및 마이크로 LED
(Self-powered Flexible Devices: Piezo-sensor and microLED)

초록

This seminar introduces two recent progresses of self-powered flexible devices; piezo-sensors and microLED. The first part will introduce flexible inorganic piezoelectric membrane that can detect the minute vibration of membrane or human skin that expands the application of self-powered acoustic sensor and blood pressure monitor. Speaker recognition has received spotlight as a next big thing of voice user interface such as personalized voice-controlled assistant, smart home appliance, biometric authentication. The conventional speaker recognition was realized by a condenser type microphone, which detects sound by measuring the capacitance value between two conducting layers. The condenser type microphone, however, has critical demerits such as low sensitivity, high power consumption, and an unstable circuit due to the large gain amplification. Speaker recognition also suffers from a low recognition rate, caused by limited voice information and optimal algorithms for a simple and accurate process. Herein, we reported a machine learning-based acoustic sensor by mimicking the basilar membrane of human cochlear. Highly sensitive self-powered flexible piezoelectric acoustic sensor (f-PAS) with a multi-resonant frequency band was employed for voice recognition. The speech waveforms were recorded by the multi-channel f-PAS and converted into frequency domain signals by using Fast Fourier Transform to obtain the characteristics of voice frequency. Convolutional Neural Network (CNN) were utilized for speaker recognition, resulted in a 97.5% speaker recognition rate with the 75% reduction of error rate compared to that of the reference MEMS microphone.

The second part will discuss the highly efficient flexible vertical micro LED (f-VLED) for full color displays and biomedical applications. Flexible displays can be easily affixed anywhere, such as on the surfaces of human skin, clothes, automobiles and buildings. III-V inorganic LEDs have superior characteristics, such as long-term stability, high efficiency, and strong brightness compared to OLED. However, due to the brittle property of inorganic materials, III-V LED limits its applications for flexible electronics. Here we introduces the flexible vertical GaAs/GaN microLED on plastic substrates using micro-vacuum transfer and anisotropic conductive film. The superb properties of the flexible inorganic LED enable the dramatic extension of flexible displays toward not only full color displays and wearable phototherapy patches for skin research like hair growth and melanogenesis inhibition. In addition, combining with optogenetic mouse models, flexible microLED stimulates the neurons of motor cortex for manipulating mouse body movements and synchronized electromyogram (EMG) signals.

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