

논문 No.	Journal Title	First Author	Corresponding Author	Presenting Author	Organization
FP-3-41	투명PLZT 세라믹 기반의 압전 스피커 제작 및 성능평가	이영현	장종문	이영현	한국재료연구원, 대구경북과학기술원
FP-3-42	Simple and Rapid Fabrication of Liquid Metal-based Stretchable Sensors for Wearable Applications Based on PDMS Double Casting	김병진	정준수	김병진	부산대학교
FP-3-43	가스 용해기반 미세유체 방식의 이온 신호 증폭장치	서상진	김태성	서상진	울산과학기술원
FP-3-44	Fiber-SERS based Detection of Acetone Gas using Au Nanoislands	HWANGCHARLES	이대식	이준영	한국전자통신연구원
FP-3-45	3-channel AuCNT bladder strain sensor for volume and shape tracking of the bladder	조영준	이상훈	조영준	대구경북과학기술원
FP-3-46	Porous PDMS-based wearable sensor for radial pulse detection	니란잔	이동원	니란잔	전남대학교
FP-3-47	웨어러블 전자청진기를 이용한 진폐증 환자 폐음 분석	신한호	이수현	신한호	한국과학기술연구원
FP-3-48	MEMS 소자의 3차원 접속을 위한 고신뢰성 실리콘 관통 전극 공정 개발	나예은	박종철	나예은	나노종합기술원
FP-3-49	이온성 나노섬유막-그래핀 나노복합소재 기반 초고감도 유연 압력센서	수딕	박재영	김홍석	광운대학교
FP-3-50	Probing the energy harvesting characteristics of Lithium Niobate/PVDF based composite film	Vishal Natraj	김상재	Vishal Natraj	제주대학교

Porous PDMS-based wearable sensor for radial pulse detection

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맥박 감지를 위한 다공성 PDMS 기반의 웨어러블 센서

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Abstract

Wireless pulse pressure sensors are the future of non-invasive analysis system for diagnosis of vital health parameters. Herein, we propose a wireless LC circuit-based pulse pressure sensor fabricated using porous polydimethylsiloxane (PDMS) as dielectric. PDMS with different porosity was prepared by ultrasonic spraying method. The pulse sensor consists of a capacitor fabricated by porous PDMS membrane sandwiched between two copper electrodes and a copper inductor coil. Sensor with PDMS membranes of 0%, 10%, 50%, and 75% porosity were investigated in the preliminary examination. The sensors fabricated with 75% porosity showed an enhanced sensitivity up to 20 times compared to 0% porous PDMS on application of 300 gm weight. During analysis the radial pulse resulted in change in capacitance which was observed by the shift in resonance frequency that was detected through a wireless network analyzer. The proposed sensor is expected to be used in biomedical field to study physiological parameters.

Keywords: *Wireless sensor(무선 센서), Radial pulse detection(맥박 감지), Porous PDMS(다공성 PDMS), LC circuit(LC 회로)*

1. Introduction

Currently, cardiovascular diseases are among the leading cause of deaths in the world. The detection of heart-based issues at an early stage by monitoring the pulse is therefore necessary as a preventive measure. Till date, numerous studies have been reported on various types of pulse pressure sensors using piezoelectric, piezoresistive, and capacitive materials. However, most of the developed sensors were either not wireless or were less sensitive. Therefore, there is an urgent requirement of a wireless pulse pressure sensor with high sensitivity that can be used as a wearable device.

In this work, the advantage of wireless detection of LC circuit with low power input was explored in this work. The sensitivity was further enhanced by microengineering advancement of dielectric materials in the form of nanostructures such as

micropores, pyramids, hemispheres, lines, and bionic structures.

2. Fabrication

2.1. Fabrication of porous PDMS

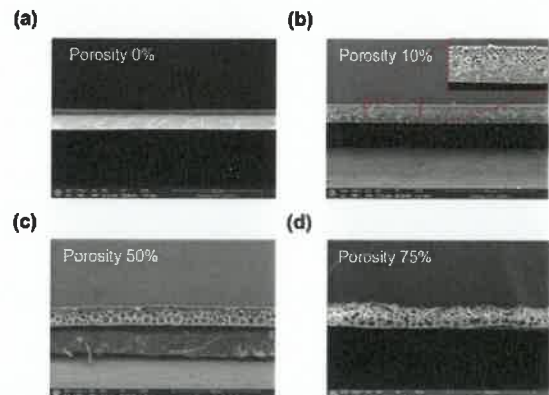


Fig. 1. The porous PDMS patches with different porosities

The porous PDMS was prepared by ultrasonic spray method (at Hanyang University). PDMS films with controlled thickness of 100 micron were deposited using spin coating technique followed by micro-sized water droplet spraying. Thereafter the films were cured at varying temperatures to obtain porous PDMS. Here, porous PDMS with different porosity of 0%, 10%, 50%, and 75% were prepared for fabricating the sensor.

2.2. Fabrication of pulse pressure sensor

The wireless pulse pressure sensor was fabricated by sandwiching porous PDMS as a dielectric between two copper strips (electrodes) and a commercial copper inductor. PDMS with different porosity was utilized to fabricate and compare the performance of sensor. Firstly, we analyzed capacitance of all the prepared porous PDMS films with varying applied weight. Notably, a change in capacitance was observed with increased applied weight for all the samples. Thereafter, a commercial inductor was coupled to the capacitor to form an LC-circuit. Using

network analyzer, the shift in resonance frequency on application of weight was recorded. The highest shift in resonance frequency was observed for 75% porous PDMS due to high compressibility. Therefore, the same 75% porous PDMS sensor was utilized to fabricate wireless pulse sensor and tested by attaching it to the human wrist. The periodic flicks in resonance frequency due to pulse were recorded using network analyzer.

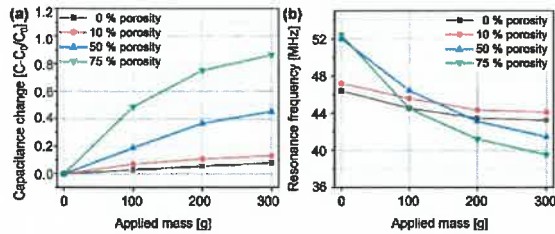


Fig. 2. (a) Change in capacitance of porous PDMS with respect to applied mass, (b) resonance frequency of the pulse pressure sensor with applied mass.

3. Results

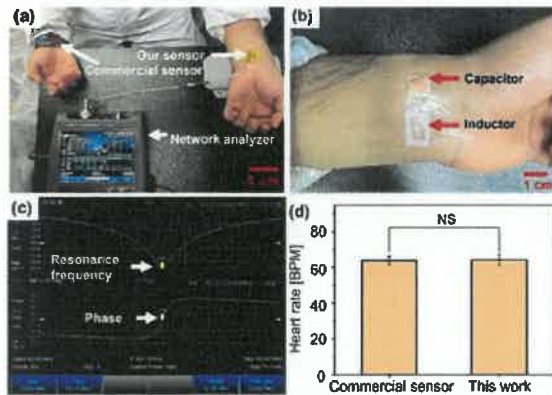


Fig. 3. (a) Images of sensor for detection of radial pulse using Network analyzer and comparison using commercial pulse sensor; (b) attached sensor on wrist; (c) Resonance frequency detected using Network Analyzer; (d)

During pulse detection, the number of periodic flicks per minute were found to be matching with the pulse rate [BPM] measured using commercial pulse sensor.

Acknowledgments

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