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A multi-layered touch-pressure sensing ionogel material suitable for sensing integrated actuators of soft robots

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HIGHLIGHTS

- Capacitance changes linearly with pressure despite of gel thickness.
- A touch locating gel layer and a pressure sensing capacitor form a sensing material.
- Distributed sensing system miniatures show good touch-pressure sensing performances.
- It allows large scale sensing with low interferences and actuator integration.

Abstract

Soft robots have been a focus of studies for their advances of softness and body compliance. They are needed to be developed using materials that integrate sensors and actuators to fulfill their application potentials. This work followed our previous study on a capacitor-like ionogel-based soft actuator. Capacitance responses to loads of this ionogel-based parallel capacitor were observed, indicating its pressure sensing possibilities. Furthermore, a linear relationship between capacitance and load pressure was found despite of gel thickness. In order to locate the pressure, a novel touch-pressure sensing material was built. It was a multi-layered material with a layer of VHB tape (3M, United States) sandwiched by this pressure sensing capacitor on the bottom and a single layer of gel on the top for touch locating. Studies on a simple array (2×2) of distributed sensing systems based on this material showed good touch and pressure sensing performances. This design would allow a large scale distributed sensing system with low interferences between physical stimulations. It will then benefit quick control algorithms based on a single physical stimulation, such as touch avoidance or force control. Further research will be carried out to integrate this material with ionogel soft actuators.

Keywords: intelligent material, touch-pressure sensing, ionogel, actuator-sensor integration, soft robot

1. Introduction

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