Abstract
Action potential, a physiological process controlled by programmed opening and closing of several ion channels, is the basis for heart beating and neuronal firing. Malfunction or dysfunction of action potential has led to varied heart and brain diseases. Accurate recording action potential thus is important for both fundamental study and drug screening and has become the central goal for the contemporary bioelectronics’ development. Gold standard technique, microelectrode array, is a powerful tool but has suffered from low signal to noise issue. Transistor was then introduced into this area to tackle the problem by taking advantage of its built-in amplification mechanism. Different configuration and materials based transistors have been intensively studied for last decade.

With attractive attributes of ionic conductivity, mechanical flexibility and synthetic tunability, organic electroactive materials, as a recent endeavor, have been widely implemented in bioelectronics for varied applications. Previously we have used organic electrochemical transistor (OECT) for recording transepithelial ion transport from human airway epithelial cells, which shows excellent coupling of ionic currents to electrical ones. Since action potential is an ionic current-centered process, we believe it’s promising to use OECT for recording action potentials with high signal to noise ratio.

In this study, both rigid and flexible OECT arrays were fabricated and used to record action potentials from cardiomyocyte-like HL-1 cells. High signal to noise action potential signals were successfully recorded. With an array design, heterogeneity in HL-1 cell layer was resolved. The feasibility of using OECT array as a drug screening platform for evaluating action potential targeted chemicals was also demonstrated.