INTERDIGITATED ARRAYS FOR THE MEASUREMENT OF ELECTRIC AND ELECTROCHEMICAL CHARACTERISTICS OF BIOLOGICAL SAMPLES

José M. Rodríguez-Delgado, Melissa M. Rodríguez-Delgado, Christian Mendoza-Buenrostro, Graciano Dieck-Assad, Diana L. Cárdenas Chávez, Roberto Parra Saldívar, Sergio O. Martínez-Chapa
BioMEMS and Biointeractive Systems Research Group, Electrical and Computer Engineering Department, Tecnológico de Monterrey.
Centro del Agua para América Latina y el Caribe, Tecnológico de Monterrey. Monterrey, 64849, r.parra@itesm.mx

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Introduction. In this work we compared two methodologies for the characterization of biological samples with two Interdigitated Arrays (IDA's) of different size and material. The characteristic measured on the firs IDA corresponds to an impedance measurement of the biological sample, a change in impedance is detected over an IDA made of cooper electrodes on a Printed Circuit Board (PCB) [1]. The second measurement corresponds to the electrochemical characteristics of a biological sample using an IDA made of carbon electrodes over a silicon wafer [2]. Both methodologies were used to characterize the different responses of the biological sample and measure the responses of IDA's.

Methods. We used an electrical resistance connected in series with the IDA forming an electrical circuit. With a function generator, a sine wave was generated and connected to this circuit. Measuring differences in voltage and phase between the resistor and IDA we can characterize the electric properties of the sample over the IDA. The second tests were done using a biological sample over a carbon IDA; measurements of the electrochemical characteristics on these samples were done using a triangular voltage wave and measuring the current generated by the reduction-oxidation reaction.

Results. Using the voltage divider methodology with the PCB IDA, we could observe that a change in the biological samples is represented by the difference in the dielectric properties of the samples and the IDA working as a capacitor which stores energy as an electric field between the array. A change in the properties of the material over the array changes the capacitance parameter as illustrated in table1. The second methodology used with the carbon IDA shows how an array of electrodes made with carbon is compatible with electrochemical measurements. A potential between one of the electrodes form the IDA and a reference electrode is applied while a current was measured on the complementary carbon electrode. Plots of voltage versus currents in Figure 1 shows a relation between the current measured and the kind of sample over the electrodes, with a clear increase on the currents due to the different reduction-oxidation potentials of the samples.

Table 1. Measurements of capacitance of the cooper IDA with different samples.

Biological Sample	Capacitance (nFarads)
Laccase (bi-distilled water)	8.36
Laccase + ABTS (bi-distilled water)	45.5
Phosphorus Buffer	49.1

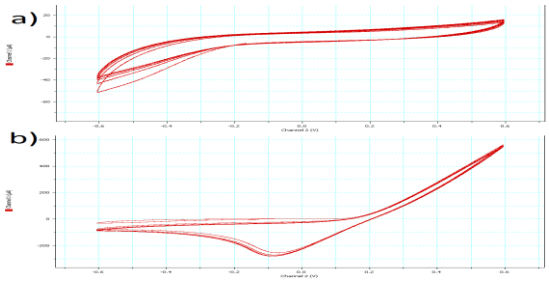

Fig.1 Cyclic Voltammetry of a) Acetate Buffer, b) Acetate Buffer + Hydroquinone

Conclusions. These methodologies can detect changes in the samples using electrical and electrochemical reactions, integrating these two methodologies, development of sensors can be enriched and simplified.

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