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A Surface Impedance Imaging Technique

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Inventors

Nongjian Tao, PhD
Professor
Electrical Engineering
Arizona State University

Kyle J. Foley
Graduate Research Associate
Electrical Engineering
Arizona State University

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Patent Pending

Contact

Yash Vaishnav, PhD, MBA

Vice President

Business Development, Life Sciences

Arizona Technology Enterprises, LLC (AzTE)

P: 480.884.1648

F: 847.971.2871

YASH@AZTE.COM

HEALTHSCIENCES@AZTE.COM

Invention Description

Surface or interfacial impedance spectroscopy has been established as a powerful technique for many applications, ranging from electrochemistry and corrosion analysis to biochips and biosensors. Most applications utilize a single or an array of electrodes and an electrical instrument to perform impedance measurement and analysis, which does not have imaging capability. Atomic force microscopy has been used to probe local capacitance, but it is impractical for routine analysis because it is slow and complicated. It is highly desired to image or map the local impedance of the entire surface of an electrode, which so far has not been demonstrated.

In an important development at ASU, researchers have invented a method which allows the imaging of surface impedance in real time. In addition, it also allows the monitoring of molecular binding processes without using labels, which is particularly useful for biochips and biosensors. Finally, the technique can provide information about the charge of biomolecules adsorbed on a sensor surface, which provides additional insight into the functions of the molecules. The basic principle of the technique relies on the sensitive dependence of surface plasmon resonance (SPR) on local surface charge density. By applying a potential modulation to an electrode surface, it is possible to obtain an image of the DC component and the amplitude and phase images of the AC component. This allows a new dimension of imaging that is currently not possible with conventional SPR techniques.

Potential Applications

This technology will facilitate the imaging of surface impedance in solution, which will be important to researchers working in the following fields:

- **Biochips**
- **Biosensors**
- **Drug discovery**
- **Diagnostics**
- **Electro analysis**

Benefits and Advantages

- **Fast:** Interface images can be generated in real time
- **Novel:** This technique is reported to be the first that can image the local impedance of an entire electrode surface.
- **Better Contrast:** This technique will reveal interface features that are not possible with conventional SPR imaging techniques.
- **Ease of Use:** Allows the monitoring of molecular binding processes without using labels.