

Contact Information

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Research Areas and Interests

DNA SPECIFIC SENSOR

Hypermethylated DNA can be detected in body fluids from prostate cancer patients and may be a useful biomarker as opposed to PSA which is relatively unspecific. The goal of this project is to analyze altered strands of DNA which are prevalent in prostate cancer patients, such as the hypermethylated GSTP1 promoter, to allow for a more selective and sensitive screening tool for prostate cancer. A novel electrochemical sensing technique has been developed and utilized for the detection of the methylated strands of DNA specific to prostate cancer patients. This will allow for a low-cost, fast and specific detection tool for prostate cancer screening versus current techniques which are considerably more costly, slow, non-specific and invasive. Our label-free electrochemical detection of DNA hybridization is based on a simple electrochemical technique called cyclic voltammetry (CV) in which the current at the working electrode is plotted versus the applied voltage to give the cyclic voltammogram. A custom-developed 16-channel microelectrode array chip is covered with electropolymerized conducting polymer bilayer consisting of polypyrrole (PPy) and poly[2,5-dithienyl-(N-3-phosphorylpropyl)pyrrole] (pTPT), which acts as electrochemically controlled ion-exchanger during the CV. In a chloride-containing buffer, the rate of exchange of chloride ion, and thus the shape of CV, is affected by the electrostatic barrier at the electrode/buffer interface. Upon hybridization of the ssDNA probe with its complementary ssDNA target, the charge at the sensing layer increases, hindering the exchange of chloride ions which in turn reduces the current flow and affects the shape of the CV. The identification of the hybridization event is then obtained by subtraction of the individual CVs after and before the hybridization event.

Teaching

Principles of Chemistry I (CHEM 1211K)

Principles of Chemistry II (CHEM 1212K)

Scientific Mathematics (CHEM 2310)

Quantitative Analysis I (CHEM 3151K)

Quantitative Analysis II (CHEM 3152K)

Polymer Science (CHEM 3400)

Instrumental Analysis (CHEM 4100K)

Senior Research I (CHEM 4120)

Professional Experiences

Active member of the American Chemical Society (ACS) and Electrochemical Society (ECS) since 2010.

Publications

- **A. Saheb**, K. Meronard, M. Josowicz “Voltammetric Label-free Detection of DNA Hypermethylation Using Polypyrrole-modified Microelectrode Array” *Electroanalysis*, 31, **2019**, 1934-1942.
- **A. Saheb**, K. Meronard, M. Josowicz, “Voltammetric Application of Polypyrrole Modified Microelectrode Array for the Characterization of DNA Methylation in Glutathione S-Transferase Pi 1” *Analytical Letters*, 51, **2018**, 2612-2625.
- **A. Saheb**, S. Patterson, M. Josowicz, “Probing for DNA Methylation with a Voltammetric DNA Detector” *Analyst*, 139, **2014**, 786-792.
- **A. Saheb**, M. Leon, M. Josowicz, “Electrochemical Assay of GSTP1-related DNA Sequence for Prostate Cancer Screening,” *Interface*, 21, **2012**, 71-75.
- **A. Saheb** and S. Seo “Polyaniline/Au Electrodes for Direct Methanol Fuel Cells” *Analytical Letters*, 44, **2011**, 2221-2228.
- **A. Saheb** and S. Seo “UV-Vis and Raman Spectral Analysis of Polyaniline/Gold Thin Films as a Function of Applied Potential,” *Analytical Letters*, 44, **2011**, 1206-1216.

- **A. Saheb**, M. Josowicz, J. Janata, “Field-Effect Transistors with Mixed Ionic-Electronic Gate”, *Electroanalysis*, 21, **2009**, 290 – 294.
- **A. Saheb**, M. Josowicz, J. Janata, “Chemically Sensitive Field-Effect Transistor with Polyaniline-Ionic Liquid Composite Gate”, *Analytical Chemistry*, 80, **2008**, 4214-4219.
- **A. Saheb**, J. Anthony Smith, J. Janata, M. Josowicz, Don Baer, Mark Engelhard “Controlling Size of Gold Clusters in Polyaniline from Top Down and from Bottom Up” *Journal of Electroanalytical Chemistry*, 621, **2008**, 238-244.
- **A. Saheb**, J. Janata, M. Josowicz “Reference Electrode for Ionic Liquids” *Electroanalysis*, 18, **2006**, 405 – 409.
- **A. Saheb**, M. Josowicz, J. Janata, B. Mattes “Electropolymerization of Aniline from Ionic Liquids” in *Electrode Processes*. Proceedings of the International Symposium of the Electrochemical Society, Pennington, NJ, 18, **2004**, 192-203.

Recent Grants

- **“DNA SPECIFIC SENSOR FOR PROSTATE CANCER BIOMARKERS”** Project PI for Hampton University’s MMHI program in the amount of \$312,688 (2015-2019).
- NIH-RIMI grant, \$370,093, sub-project PI (2011- 2013).

Awards and Honors

- NSF Supplemental Funding Award for Summer Research Internship at PNNL, Richland, WA, 2006.
- Outstanding Achievement in Teaching Award, 2003.

Education

Doctorate of Philosophy in Chemistry, Georgia Institute of Technology, Atlanta, GA

Masters of Science in Chemistry, Georgia Institute of Technology, Atlanta, GA

Bachelor of Science in Chemistry, Georgia Institute of Technology, Atlanta, GA