

---

# **Solid-State Electronics and Photonics in Biology and Medicine 7**

---

## **Editors:**

**Y.-L. Wang**

**W. Wu**

**Z.-H. Lin**

**A. M. Hoff**

**C.-T. Lin**

**L. F. Marsal**

**J. Deen**

**T. Sakata**

**Z. P. Aguilar**

## **Sponsoring Divisions:**



**Electronics and Photonics**



**Sensor**



Published by  
The Electrochemical Society  
65 South Main Street, Building D  
Pennington, NJ 08534-2839, USA  
tel 609 737 1902  
fax 609 737 2743  
[www.electrochem.org](http://www.electrochem.org)

**ecstransactions™**

**Vol. 97, No. 6**

---

Copyright 2020 by The Electrochemical Society.  
All rights reserved.

This book has been registered with Copyright Clearance Center.  
For further information, please contact the Copyright Clearance Center,  
Salem, Massachusetts.

Published by:

The Electrochemical Society  
65 South Main Street  
Pennington, New Jersey 08534-2839, USA

Telephone 609.737.1902

Fax 609.737.2743

e-mail: [ecs@electrochem.org](mailto:ecs@electrochem.org)

Web: [www.electrochem.org](http://www.electrochem.org)

ISSN 1938-6737 (online)

ISSN 1938-5862 (print)

ISSN 2151-2051 (cd-rom)

ISBN 978-1-62332-606-7 (CD-ROM)

ISBN 978-1-62332-607-4 (USB)

ISBN 978-1-60768-894-5 (PDF)

Printed in the United States of America.

---

## Table of Contents

*Preface* *iii*

### **Chapter 1** **FET-Based Sensors**

Fabrication of Heavy Metal Ion FET Based Sensor for Detecting Arsenite 3  
*S. S. Tatavarthi, Y. L. Wang*

Functionalization of Polymeric Nanofilter Biointerface for Small Biomarker Sensing 9  
*T. Fukuma, S. Nishitani, T. Sakata*

Evaluation of Skin Cell Damage Under UV Exposure with FET Sensors 15  
*S. Y. Wu, C. M. Su, G. C. Dong, J. C. Chen, P. H. Chen, S. L. Wang, C. R. Wu,  
C. W. Chiang, Y. L. Wang*

A Self Powered Solid-Liquid Contact Electrification Based Nanosensor for  
Chemically Enhanced Detection of Catechin 21  
*S. Chatterjee, Z. H. Lin*

### **Chapter 2** **Emerging Sensing and Diagnostic Systems 1**

Ultrasensitive and Label-Free Detection of Mercury Ions Using a Highly Efficient  
Solid-Liquid Triboelectric Nanosensor 29  
*S. Roy Barman, H. S. Wu, Z. H. Lin*

### **Chapter 3** **Emerging Sensing and Diagnostic Systems 2**

Investigation of Highly Sensitive Cadmium Ion Selective FET Sensors with AC Impedance Analysis 37  
*S. L. Wang, C. Y. Hsieh, Y. L. Wang*

Demonstration of EDL Modulated FET Biosensors with Impedance Analysis 43  
*C. R. Wu, S. L. Wang, P. H. Chen, J. C. Chen, Y. L. Wang*

#### **Chapter 4** **Energy Harvesting, Storage, and Self-Powered Applications 2**

*(Invited)* Development of the High Performance Triboelectric Nanogenerator with a Mechanical Mediator for Its Practical Utilization 51  
*D. Choi*

Development of Wear-Resistant Energy Harvesting Devices and Self-Powered Systems Based on Bionic Design 55  
*M. Z. Huang, Z. H. Lin*

#### **Chapter 5** **Emerging Sensing and Diagnostic Systems 3**

A Biomechanical Energy Based Wearable Sensor System for Real Time Human Gait Phase Detection and Postoperative Trauma Monitoring 65  
*C. Yeh, H. S. Wu, Z. H. Lin*

Improvement in NO<sub>2</sub> Gas Sensing Performance Using Igzo Film Sensor 71  
*S. B. Eadi, J. K. Jeong, H. S. Song, G. W. Lee, H. D. Lee*

Sputtered Thermoelectric Nanoparticles for an Ultra-Thin, Flexible and Cuttable Self-Powered Temperature Sensor 79  
*Z. H. Lin, I. Khan*

Author Index 85