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Editorial

Special Issue on Novel Technology and Applications of Micro/Nano Devices and System

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The development of novel technologies and applications for micro/nano devices is an interdisciplinary subject that demands an integration of several research fields, such as material science, biotechnology, medicine, chemistry, informatics, optics, electronics, mechanics, and micro/nanotechnologies. In this regard, this Special Issue on "Novel Technology and Applications of Micro/Nano Devices and Systems" seeks to gather the ultimate breakthroughs and innovative development techniques used in this multidisciplinary area, aiming toward an end-use of this technology.

Researches from different areas and backgrounds cooperated actively through submission of high-quality research to this Special Issue, focusing on the latest advances and challenges in micro/nano devices and systems. Therefore, a total of seven research papers in various fields of micro/nano devices are presented including novel technology and novel materials developed for a wide range of applications, such as biomedical, biotechnology, marine, automotive, specifically focusing in MEMS gyroscope, temperature microsensors, microparticles for controlled drug delivery, monitoring of dynamic blood flows, novel methodologies for improvements in phytoplankton identification, modeling of CMOS photodiodes and noise reduction on Nanopore filter.

Pistorio et al. [1] reported the design of a new structurally and thermally stable resonant mode-matched electrostatic z-axis MEMS gyroscope to improve the reliability of the measurements with respect to environmental and constructive imperfections. The proposed design was optimized by a detailed coupled-field electric-structural-thermal finite element method (FEM)-based analysis considering the microfabrication process limitations of low cost and commercially available silicon-on-insulator multi-user MEMS processes (SOIMUMPs) microfabrication process [1]. Sousa et al. [2] presented the design, fabrication and characterization of miniaturized temperature sensors based on Resistance Temperature Detectors (RTDs) with high potential to monitor the transient and long-term response about the cellular microenvironment inside an organ-on-a-chip, which will add essential information for the screening of new drugs. The authors demonstrated that the small size and good resolution of the developed miniaturized sensors allow real-time and in situ monitoring with a resolution of 0.1 °C in the range from physiological (35 °C) to hyperthermia (45 °C) temperatures [2]. Jusu et al. [3] investigated the development of drug-encapsulated polymeric microparticles for the controlled release of cancer drugs in treatment of breast cancer. The authors studied the physicochemical and morphological properties of the synthetized microparticles and experimentally analyzed the kinetics and thermodynamics of the in vitro drug release from microspheres at hyperthermic and human body temperatures [3]. Kang [4] presented a new method for monitoring the blood flow using a coflowing channel as a pressure sensor. This method uses four properties of the blood flow (i.e., pressure, shear stress, pressure unit volume work and shear stress unit volume work) to monitor blood flow continuously over time. The authors reported several advantages of the proposed method comparatively with conventional methods,

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namely it can measure blood pressure under continuous blood flow and obtain pressure or shear stress of the fluid by measuring the interface in the laminar stream using a sensorless approach. In addition, the authors demonstrated the implemented method by experimental quantification of the test fluids (i.e., glycerin, blood) under different flow patterns (i.e., constant flow rate, sinusoidal flow rate, and peristaltic flow rate) [4]. Ferreira et al. [5] reported a numerical approach to predict the photodiodes' quantum efficiency performance for different CMOS technologies and different p–n junction structures helping to select the best structure design for certain application before their microfabrication. The authors demonstrated that COMSOL is a tool that enables the numerical characterization of CMOS silicon photodiodes with relative confidence [5]. Carvalho et al. [6] presented the main optical properties (absorbance and fluorescence) of three phytoplankton species and an identification methodology toward the development of a portable and low-cost lab-on-a-chip device suitable to detect phytoplankton taxonomic group. Furthermore, the authors presented a preliminary validation of an electronic circuit based in a lock-in amplifier suitable for chlorophyll measurements, which can be adapted for detecting the fluorescence of primary photosynthetic pigments (chlorophyll a) and accessory pigments (carotene, chlorophyll b, phycoerythrin, phycocyanin, and others) present in microalgae and cyanobacteria to quantify different phytoplankton species [6]. Huang et al. [7] reported a signal noise reduction method for nanopore-based detection technology, which is an indispensable tool for monitoring ion current flow in single molecule experiments. The authors showed that the new method for noise reduction offers a better performance than the traditional Kalman filter method and can have a great impact on the analysis of biomolecular properties [7].

As Guest Editors, we hope this Special Issue can provide an opportunity to the engineering and materials science community, as well as those who are interested in the general field of novel technologies and novel materials for micro/nano devices to access and exchange novel knowledge and information.

Finally, we would like to acknowledge, congratulate and thank all the authors for submitting their original manuscripts to this Special Issue, as well as all the reviewers for the time and efforts to improve the quality of the submitted papers.

Although submissions for this Special Issue have been closed, more in-depth research in the field of micro/nano devices and system are expected to address the challenges of miniaturization and integration in sensitive, portable and low-cost devices.

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