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Special issue: Micro-electromechanical systems (MEMS)

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This special issue in *Frontiers of Mechanical Engineering* contains twelve papers contributed by international prestigious groups in micro-electromechanical systems (MEMS) research area, including four research papers, seven review papers, and one short communication. These papers cover the latest advances of structure design, micro-nanofabricating technologies and the exciting applications with MEMS. Some interesting fabrication methods such as self-assembly and thermal shrinking, electrohydrodynamic jet and direct-write methods are presented, and the extended applications in wireless, bio and biochemical, medical equipment, energy storage, flexible and aerospace systems are comprehensively reviewed to provide readers with a clear picture of the latest MEMS development.

Prof. Jiang's group develops a novel MEMS piezoresistive pressure sensor with diagonal positioned peninsula-island structure. The smart design delivered the sensor with high sensitivity, enough resolution ability and accuracy for ultra-low pressure measurement. It suggests the developed MEMS sensor has strong potential in medical equipment application.

Prof. Cui's group combines low-cost layer-by-layer self-assembly and thermal shrinking techniques to fabricate graphene sensor for biosensing. By adjusting shrink temperature, graphene nanowrinkles can be achieved on shape memory polymers. Large-surface area with the roughed surface and desired wettability can be tuned in sensing applications for pH and alpha-fetoprotein detection.

Prof. Huang's group studies the effect of environmental media on the transmission of an inductive link in wireless microsystems. Through theoretical and experimental investigations on the scheme of inductor-capacitor passive wireless sensors, it suggests that the capacitive link would be non-negligible on some scale, especially when the environment medium has a large dielectric constant.

Prof. Xia's group presents a novel single-chip three-dimensional electric field microsensor with the smart design and the sensor performance is experimentally examined. The proposed microsensor has the advantages of small size and high integration, which can be fabricated by MetalMUMPS process.

Prof. Zhu's group summarizes their works on micro flexible flow sensors fabricated on a flexible polyimide PCB by a low-cost hybrid process of thin-film deposition combined with circuit printing. The wind tunnel experiments using the sensors integrated on the micro aerial vehicles (MAVs) are also demonstrated. The flow sensor takes traits of flexibility, simple structure, easily integrating with circuits, good sensing performances. It shows that the sensor can be applied to MAVs for detecting surface flow variation around the aircraft wing and further deducing aerodynamic parameters of the MAVs in flight.

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Prof. Li's group presents an in-depth review on Si-based three-dimensional micro-batteries and the related fabrication technologies. It shows that the micro-batteries can be designed and fabricated with Si-technologies on silicon substrate to power micro/nano electro mechanical systems (MNEMS) and lab-on-chip smart electronic devices.

Prof. Sun's group reviews on the latest progress of digital microfluidics (DMF) for biochemical applications concerning automation and miniaturization. It is worth noticing that DMF facilitates precise control over multiple reaction process and has unique advantages such as portability, less sample consumption, shorter chemical reaction time, and flexible and easy combination with other kinds of technologies.

Prof. Liding Wang's group introduces an electrohydrodynamic jet deposition/printing method to fabricate micro/nanostructures for MNEMS as well as their applications. It shows that the approach as the advantage of controlling the droplet size at the nanoscale, which contributes high printing resolution and less risk of nozzle blockage.

Prof. Yuelin Wang's group presents a perspective review on MEMS-based thermoelectric infrared sensor and the state-of-art of sensor implementation technology. The device physics, the figures of merit, sensing material, thermal isolation microstructure, absorber design and packaging method are discussed on the basis of different examples.

Prof. Yuan introduces the aerospace MEMS design and manufacturing technology with special characteristics of high performance, multi-variety and small batch. Several kinds of special MEMS devices with high precision, high reliability and environmental adaptability are presented for their typical applications in the fields of aeronautic and aerospace.

Prof. Teh presents a detailed discussion on direct-write additive manufacturing method for potential application in MEMS microfabrication. It shows that direct-write techniques at the microscale have the potential to significantly lower the barrier-of-entry-in terms of cost, time and training for the prototyping and fabrication of MEMS parts that have larger dimensions, high aspect ratios, and complex shapes.

Prof. Zuo's group provides an up-to-date overview on the application of differential scanning calorimetry (DSC) in biomolecular study as well as the recent advances of the development of MEMS based DSCs.

At the end of this editorial, I would like to express our sincere appreciations to all authors who have contributed their work for this special issue. I am also grateful to all reviewers for their commitment to the special issue through their insightful and constructive comments, and timely response to the tight schedule.

Guest Editor:

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