HIGH PERFORMANCE MEMS SENSORS AND ACTUATORS

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Abstract

MEMS technology relates to research and development of micro/nano electro-mechanically integrated sensors and actuators fabricated based on microelectronic technology with high accuracy and throughput. MEMS devices possess many advantages, such as miniaturization, multifunctional integration, high performance, mass production, low cost. MEMS sensors have been widely used in consumer and industrial applications, such as automotive, biomedical, robotics, smart home/city, defense, etc. It is forecasted that the market for MEMS sensors will grow up to US$100 billion in 2023 [1].

This work presents our innovative micro sensors and actuators developed based on Si and SiC MEMS technology. Compared to Si MEMS, SiC MEMS sensors can work more reliably in harsh conditions, e.g. high temperature and/or strong chemical corrosive environments, thanks to SiC's unique properties, such as larger bandgap, higher thermal stability, higher breakdown voltage, higher Young's modulus than Si material. We recently have successfully developed mechanical, thermal and optical MEMS sensors with high sensitivity and wide working temperature range. For example, optoelectronic coupling in a SiC/Si heterojunction exhibited an ultra-high sensitivity (gauge factor) of up to 58,000 which is the highest sensitivity ever reported to date [2].

Our successful demonstrations of mechanical, thermal and optical sensing concepts and devices could open a new door for development of high-performance MEMS sensors from research point of view to a wide range of potential applications.

Key word: MEMS, Sensors, Actuators

Short- Biography

Assoc. Prof DAO received his PhD degree from Ritsumeikan University, Japan in 2003. He then served as a Postdoctoral Research Fellow from 2003 to 2006, Lecturer from 2006 to 2007, and Chair Professor from 2007 to 2011 all at Ritsumeikan University. From 2011, Dr Dao joined Griffith University, Australia, where he is currently the Head of Mechanical and Mechatronics Engineering.

A/Prof Dao's research interests include Nanotechnology, MEMS sensors & actuators, and micro/nano Mechatronics. A/Prof Dao has secured over $6.5M research income, published over 350 papers in scientific journals and conference proceedings, 5 books/book chapters, and filed 17 patents. A/Prof Dao is currently the Chair of National Committee on Mechatronics, Engineers Australia.

References:

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