



Title: High-Pressure High-Temperature Bulk-Type Silicon Pressure Sensor for Oil Exploration

Speaker: Prof. Kevin Chau, Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing, China

Time: 2019.04.30 14:00-15:00

Venue: Room 202-2, Taizhou Hall

Host: Prof. Fei Wang

>>> 嘉宾简介 Introduction

Kevin Chau is Professor at the Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing, China. He is also Adjunct Professor of Electronic & Computer Engineering at the Hong Kong University of Science and Technology. Prof. Chau received his BS degree with First Class Honors from the University of Hong Kong in 1980, his MS and PhD degrees from the University of Michigan in 1981 and 1987, respectively, all in Electrical Engineering. He invented the “Dissolved-Silicon-on-Glass Wafer Process” during his doctoral research, which later found commercialization at Ford Microelectronics, Inc. (for accelerometers), Draper Laboratory/Rockwell/Honeywell (for gyroscopes), and Integrated Sensing Systems, Inc. (for pressure and flow sensors). It was the educational MEMS process of choice for the Integrated Microsystems Laboratory Course at the University of Michigan for around a decade. Prof. Chau became the first MEMS PhD hired at Analog Devices, Inc. (ADI) in 1992. He was pivotal in overcoming early technical hurdles, which subsequently led to the successful release of the ADXL50, the world’s first integrated surface-micromachined accelerometer. For the next 14 years at ADI, Prof. Chau continued to play key technical and managerial roles in MEMS development and oversaw the proliferation of high volume accelerometer products ranging from airbag crash sensors for automobiles to motion sensors for consumer electronics like the Nintendo Wii, with over 250 million units shipped by 2006. He has been granted 16 US patents. Due to an insatiable desire for knowledge, Prof. Chau turned to computer music and received the MA degree in Music, Science, and Technology from Stanford University in 2013. He was elected “State Specially Recruited Experts” under China’s Thousand Talents Plan in 2014.

>>> 报告简介 Course Content

Conventional diaphragm-type silicon pressure sensors are not appropriate for operating in a downhole environment in which the pressure can reach 200 MPa (2000 atmospheres) and temperature 225 °C. A bulk-type silicon pressure sensor that does not require fragile deformable diaphragm-like microstructures is more suitable, the theoretical feasibility of which will be discussed. Operating on a bulk-sensing principle, external hydrostatic pressure acting on the sensor is converted to a biaxial compression inside an all-silicon encapsulated vacuum cavity. The biaxial compression is measured using two orthogonal pairs of piezoresistors oriented to optimally utilize the anisotropy of silicon piezoresistance. Several enhancements of the basic sensor structure targeting higher sensitivity, operating pressure and temperature have since been proposed and demonstrated, but the full potential of this bulk-type pressure sensor has yet to be realized.

