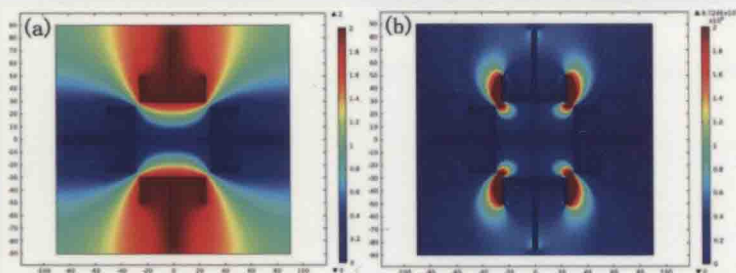
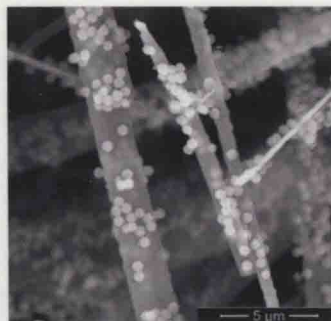
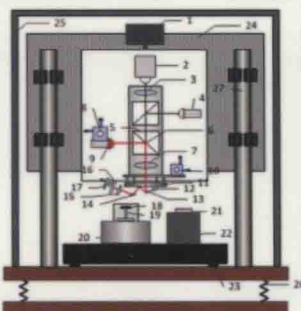


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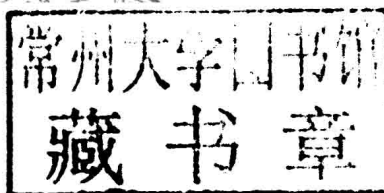
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Micro-Nano Technology XVI

PART 2

Selected, peer reviewed papers from the
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5th International Conference of the
Chinese Society of Micro-Nano Technology
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Fei Tang

TTP

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Micro-Nano Technology XVI

PART 2

Edited by
Fei Tang

Preface

This book collects papers selected from the 16th Annual conference and 5th International Conference of the Chinese Society of Micro-Nano Technology.

Micro-nano is considered as an emerging high technology for the 21st century. It involves various high-tech fields including electronics, machinery, materials, manufacturing, testing, and disciplines of physical, chemical and biological. A lot of remarkable achievements have been made in the past few years. Still it is expected that the emerging novel ideas will change people's way of thinking. The conference brings together leading scientists and engineers in Micro- and Nanotechnology to exchange information on their latest research progress. The conference provides a perfect forum for scientist and engineers of different disciplines to meet and discuss. 16th Annual conference and 5th International Conference of the Chinese Society of Micro-Nano Technology have been held in Chengdu, China. Southwest China, is one of the most modern and prosperous cities in China. The fertile Chengdu Plain, on which Chengdu is located, is also known as the "Country of Heaven". Being the birthplace of China's 4 leading cuisines in China-Sichuan Cuisine, Chengdu is widely recognized as the "Land of Abundance and Capital of Great Food" and was crowned the UNESCO City of Gastronomy of the World in 2010, the first one in Asia. With a city history of 2,300 years, Chengdu is one of the first historically and culturally famous cities nominated in China and a permanent venue for China.

In this conference, eight top level MEMS and NANO technology researchers were invited to make plenary presentations. They are:

- Horacio Dante Espinosa, the Director of the Theoretical and Applied Mechanics Program at the McCormick School of Engineering, Northwestern University;
- Qing-An Huang, the Founding Director of the Key Laboratory of MEMS of the Ministry of Education, Southeast University;
- Tianhong Cui, an Affiliate Senior Member of the graduate faculty in Department of Electrical and Computer Engineering and Department of Biomedical Engineering at the University of Minnesota;
- Quanshui Zheng, the Founding Director of Center for Nano and Micro Mechanics, Tsinghua University;
- Shangjr (Felix) Gwo, the Vice President for Research and Development in NTHU;
- SU Wei, a Ph.D supervisor and a deputy director of Institute of Electronic Engineering of CAEP;
- Jiwang Yan, a professor of mechanical engineering at Keio University, Japan;
- K.K. Jain, serves as a CEO of Jain PharmaBiotech as well as a consultant to the biopharmaceuticals industry;

Thanks the staff of Electronic Science and Technology University, China Academy of Engineering Physics and CSMNT Secretary for the efforts they have made, and thanks all honored attendees. Their contributions in all aspects are indispensable to the conference's success.

Thanks to Trans Tech Publications (TTP) for their work on publishing the special volume for selected papers of this conference. We have a good experience for cooperation, and hope that we can continue this cooperation in coming conferences in the future.

The 17th Annual conference and 6th International Conference of the Chinese Society of Micro-Nano Technology will be held in October 11-14, 2015, Shanghai, China.

Shanghai is a municipality under the direct jurisdiction of the central government. It is the city of extreme contrasts that reflect not only in its architecture or landscape, but also in its social and cultural milieu. Shanghai is an ideal "shopping paradise" in the mainland of China; Nanjing Road, known as "China's No.1 Street", and Huaihai Road are packed with rows of shops arrayed with large collections of merchandise that are a feast to the eyes. It is also a paradise for gourmets. There are over a thousand restaurants serving the famous 16 styles of Chinese food. There are also French, Italian, Japanese, Indian and other kinds of foreign flavored cuisine.

See you in Shanghai!

Zheng You

Chairman of Organizing Committee

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Dissemination of Micro-gram weights from 500 μg to 50 μg Based on Automatic Mass Measuring System

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Keywords: Micro-gram Weights; Automatic Mass Measuring System; Calibration of Weights; Subdivision Method

Abstract. Microgram weights have a wide range of applications in the mechanical testing of bio-material sensors and nanotechnology market which typically involves the manufacture of objects with dimensions of less than 100 nanometers. Now it is available with a calibration certificate in National Institute of Metrology (China) that customers can be assured of full traceability to the national primary standard of mass, NO.60, which make allow customers with specialized nanotechnology applications to use the weight values range from 0.05 mg to 0.5 mg with standard uncertainty of just 0.3 μg to 0.08 μg .

In the paper, an effective method was developed to calibrate weights, along with new methods of calculating uncertainties that would satisfy OIML R111 requirements. This new calibration method involved comparing the weights with the 1 mg standard mass standards using a combination of subdivision and substitution weighing scheme.

Intorduction

The growing and evolving dynamics in mass and force measurements has inevitably necessitated the need for high precision and accurate results. As a result, measurements in micro-gram(s) and nano-Newtons levels have increasingly attracted potential research interests[1]. However, at the moment, such results have no measurement assurance since traceability to the International System of Units (SI) has not yet been developed [2].

An automatic system can reliably and accurately perform the micro-mass measurements without manual intervention. In 2007, Fröhlich and Fehling had used a fully automated mass comparator robot system to calibrate an entire 1 kg – 1 mg weight set against one 1 kg reference by subdivision in less than 1½ days [3]. Zelenka in BEV of Austria developed and realized three handling systems for automatic calibration of weights (1 mg to 10 g) on high-precision mass comparators [4]. In 2009, Chung[10]used an automatic mass comparator to calibrate of microgram weights with direct-comparison method. At the moment, NIM is undertaking research on microgram weights (range: 500 μg to 50 μg)[5]. This paper introduces the installation and operation of a robotic measurement system, and discusses a sub-multiple calibration scheme that has been adopted in calibrating selected microgram weights.

Micro-Mass Standard Measurement System

To meet the stringent requirements of an advanced metrology institute, a measurement robot system, CCR10and its housing unit (shown in Fig. 1), was set up at NIM on June 2013. This system, characterized by high calibration speed, offers efficiency in the determination of mass of weights, OIML Class E1. It consists of the following main parts: built-in mass comparator (and support table),