

8th International Tutorial Workshop on Piezoresponse Force Microscopy and Nanoscale Electromechanics of Polar Materials

August 25-27, 2010

Convention Center, University of Science and Technology Beijing
Beijing, China

First Announcement

Coupling between electrical and mechanical phenomena is ubiquitous in nature and underpins the functionality of materials and systems as diversified as ferroelectrics and multiferroics, electroactive molecules, and biological systems. In ferroelectrics, electromechanical behavior is directly linked to polarization order parameter and hence can be used to study complex phenomena including polarization reversal, domain wall pinning, multiferroic interaction, and electron-lattice coupling. The very basis of functionalities of biological systems is electromechanics - from nerve-controlled muscle contraction on macroscale to cardiac activity and hearing on micro scale and to energy storage in mitochondria, voltage-controlled ion channels and electromotor proteins on nanoscale. More broadly, electromechanical coupling is a key component of virtually all electrochemical transformations, and is a nearly universal part of energy conversion and transport processes.

The ubiquity and importance of electromechanics is belied by the lack of systematic interdisciplinary studies, due to, until recently, the dearth of corresponding nanoscale probing tools and the difficulty in quantitatively determining the relatively small electromechanical coupling coefficients. The development of piezoresponse force microscopy (PFM) and piezoelectric nanoindentation technique in the last decade has led to rapid advances in the investigation of electromechanics with unprecedented resolution. In ferroelectric materials, PFM has enabled imaging static and dynamic domain characteristics at the nanometer level, providing direct experimental observations on switching and fatigue, domain-defect interactions, and nucleation mechanisms. The last several years have also witnessed a number of spectacular advances in PFM imaging and characterization of III-V nitrides, ferroelectric and biological polymers, and expanding PFM capabilities to liquid and vacuum environments.

This workshop aims to provide in-depth description and recent advances in PFM and nanoscale electromechanics. It will introduce basic principles of PFM operation, relevant instrumental aspects, and image interpretation. The theory of cantilever dynamics, PFM contact mechanics, resolution theory, and their implications for qualitative and quantitative data interpretation will be presented. The recent technical advances, including vector PFM, high-frequency PFM, band-excitation and DRFT imaging, switching spectroscopy PFM, and imaging and polarization switching in liquids and vacuum, will also be illustrated. For ferroelectric and multiferroic materials, applications of PFM for domain imaging, nucleation center mapping, and probing polarization dynamics in thin films and capacitor structures will be presented. Electromechanical probing of biological, electroactive polymer, and soft-condensed matter systems beyond classical ferroelectric applications will also be discussed in detail.

The three-day workshop consists of **Tutorial Lectures** by PFM pioneers, **Topical Lectures** by leading scientists in the field, **Industrial Lectures** from leading PFM manufacturers, and **Poster Sessions** for attendees to discuss their own work. It also includes extensive **Lab Demos** for participants to gain hand-on experience in PFM on various commercial systems, for which the attendees can bring their own samples.

The confirmed invited speakers includes Joesph T. Evans (Radiant Technology), Alexei Gruverman (UNL), Sergei Kalinin (ORNL), Kenji Kitamura (NIMS), Andrei Kholkin (Univ. Aveiro), Chunzeng Li (Veeco), Roger Proksch (Asylum Research), Ramamoorthy Ramesh (UC Berkeley), Xiaohui Wang (Tsinghua Univ), Qingrui Yin (SIC CAS)

More information can be found at http://www.ustb.edu.cn/materials/files/pfm/International_Workshop.html. You can also contact us at jjli@uw.edu (Jiangyu Li), sergei2@ornl.gov (Sergei V. Kalinin), or workshoppfm@yahoo.cn

第八届国际压电原子力显微技术及纳米尺度极性材料和力学高级研讨会

2010年8月25日至27日

北京科技大学会议中心

第一轮通知

力电耦合现象广泛的存在于各类材料和体系中，覆盖铁电和多铁材料、电活性分子、以及各类生物系统，对其性质和功能起着至关重要的作用。例如，力电耦合效应与铁电材料的极化有序息息相关，因而能被用于研究包括极化翻转、畴界钉扎、以及多铁耦合等在内的各种复杂现象。力电耦合也支撑着许多生物体系的各种功能，从神经控制的肌肉收缩，到电势控制的细胞离子通道的开关。然而，直到最近，我们仍然缺乏在纳米尺度上对力电耦合效应进行直接观测的有效手段，尤其是不能对微小的力电耦合系数进行精确的定量测量，从而极大的限制了对材料及生物系统力电耦合效应的深入研究。

过去十年，压电原子力显微技术以及压电纳米压痕技术的快速发展，为纳米尺度力电耦合效应的研究提供了强有力的工具，极大的推动了这一领域的发展。例如，在铁电材料中，压电原子力显微镜被用于纳米尺度的电畴静态及动态成像，为铁电材料的形核、电畴翻转、电畴和缺陷的相互作用、以及铁电疲劳等各种现象提供了直接的实验证据。过去几年，压电原子力显微镜也被用于研究 III-V 族半导体、生物高分子、以及液态和真空环境下的电畴成像，从而极大的扩展了压电原子力显微技术的应用领域。

本研讨会旨在深入介绍压电原子力显微技术和其在纳米尺度力电耦合现象研究中的广泛应用，并回顾该领域当前的最新发展。研讨会涵括压电原子力显微技术的基本原理、功能、数据分析，以及各种改进和应用，涉及原子力显微镜悬臂梁的动力学、压电原子力显微镜的接触力学、精度理论、以及压电原子力显微技术数据分析等等。压电原子力显微技术的最新发展也将被深入回顾，包括矢量压电原子力显微镜、高频压电原子力显微镜、频带激振技术、双频跟踪技术、以及液态环境下的压电成像技术等等。压电原子力显微镜在铁电材料、多铁材料、生物材料、以及液态环境中的应用将被演示。参会者也将能够实际操作运用各种商业原子力显微镜，对自己的样品进行观察和测试。

研讨会为由北京科技大学承办，湘潭大学、华盛顿大学协办，为期三天，由基础讲座、专题讲座、工业界讲座、实验演示、和参会者墙报张贴五部分组成。研讨会将邀请多名压电原子力显微镜的开创先驱及国际知名学者做基础和专题讲座。多家国际知名厂商将参会演示。我们也邀请参会者带来自己的实验样品进行观察和测试。

目前，我们已确认的特邀报告人包括：Joesph T. Evans (Radiant Technology), Alexei Gruverman (UNL), Sergei Kalinin (ORNL), Kenji Kitamura (NIMS), Andrei Kholkin (Univ. Aveiro), Chunzeng Li (Veeco), Roger Proksch (Asylum Research), Ramamoorthy Ramesh (UC Berkeley), 王晓慧（清华大学），殷庆瑞（上海硅酸盐所）。

我们邀请您访问研讨会网站，

http://www.ustb.edu.cn/materials/files/pfm/International_Workshop.html,

以获取更多信息。如有疑问，请与 jjli@uw.edu (李江宇), sergei2@ornl.gov (Sergei V. Kalinin), 或者 workshoppfm@yahoo.cn（会务组）联系。