

Advanced Nanoelectronic Characterization using Conductive Atomic Force Microscopy

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Abstract

In this seminar, I will show our recent work in the field of advanced materials for solid-state microelectronic devices. I will describe some of the properties we have analyzed in graphene, molybdenum disulfide, hexagonal boron nitride, ZnO nanowires, and transition metal oxides. I will describe the setups that we have developed in order to carry out these studies, with special emphasis in conductive atomic force microscopy. The main properties that we will discuss are related to the dielectric breakdown process and resistive switching, including tunneling current, charge trapping and de-trapping, random telegraph noise, trap-assisted tunneling, stress-induced leakage current, soft and hard dielectric breakdown and resistive switching. We will also comment on the observation of piezoelectricity using the conductive atomic force microscope. Finally, I will present our work on 2D materials based memristors, and how this technology could be useful for the development of efficient hardware for neuromorphic computing and artificial intelligence systems.

Biography of Presenting Author



Mario Lanza is a Full Professor at Soochow University (world rank: 11th according to Shanghai Ranking, 19th according to US News, and 27th according to Nature Index). Dr. Lanza got his PhD in Electronic Engineering with honors in 2010 at Universitat Autònoma de Barcelona. During the PhD he was a visiting scholar at The University of Manchester (UK) and Infineon Technologies (Germany). In 2010-2011 he was NSFC postdoc at Peking University, and in 2012-2013 he was Marie Curie postdoc at Stanford University. Prof. Lanza has published over 100 research papers, including Science, Nature Electronics and IEDM, edited a book for Wiley-VCH, and registered four patents (one of them granted with 5.6 Million CNY). Prof. Lanza is member of the advisory board of several journals, including

Advanced Electronic Materials, Scientific Reports, Nanotechnology, Nano Futures and Crystal Research and Technology, as well as guest editor of a special issue in Advanced Functional Materials. He is an active member of the technical committee of several world-class international conferences, including IEEE-IEDM, IEEE-IRPS, IEEE-IPFA and APS. Prof. Lanza has received the 2017 Young Investigator Award from Microelectronic Engineering (Elsevier), and the 2015 Young 1000 Talent award (among others), and in 2019 he was appointed as Distinguished Lecturer of the Electron Devices Society (IEEE-EDS). Since 2013, Prof. Lanza leads a research group formed by 15-20 PhD students and postdocs at Soochow University, and they investigate how to improve electronic devices using 2D materials, with special emphasis on two-dimensional (layered) dielectrics and memristors for non-volatile digital information storage and artificial intelligence computing systems.

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