**Revealing anisotropy in MoS2 nanosheets grown on self-organized nanopatterned substrates**

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Among transition metal dichalcogenides, molybdenum disulphide (MoS2) has gain tremendous interest due to its unique physical and chemical properties arising at ultralow thickness. Due to its weakly interacting layered bulk structure, exfoliated MoS2 is easily obtained and employed in prototypical devices such as field effect transistors and photodetectors, characterizing its semiconducting behavior and its suitability for low-power and ultra-scaled nano- and opto-electronics. However, for industrialization, MoS2 synthesis on large scale with atomic thickness control is mandatory and chemical vapor deposition approaches from Mo and S precursors are widely used. In this framework, the sulfurization process at high temperature (~850°C) of a molybdenum precursor solid thin film pre-deposited on a substrate has the peculiarity that the morphology of the precursor film plays a primary role in driving most of the structural properties of the so-grown MoS2 nanosheets, as we recently reported for the granularity observed in MoS2 layers obtained from sulfurization of electron-beam deposited films. Additionally, when our approach is coupled with a pre-patterned rippled (SiO2) substrate we are able to introduce anisotropic structural modifications to the grown MoS2 nanosheets, affecting their phonon modes depending on the ripple axis, and inducing local strain and charge doping in close relation with the MoS2 corrugations. We explicit such correlation by combining spatially resolved Raman spectroscopy and Kelvin probe microscopy. We rationalize the observed local charge variability in the rippled MoS2 as due to morphology-related modulations of the MoS2 workfunction. Finally, our approach allows a controllable tuning of the anisotropy via substrate pattern engineering.

CV (words 100-150 now 149) & Photo

Dr. Alessio Lamperti received the M.Eng. in Nuclear Engineering and Ph.D. in Radiation Science and Technology degrees from Politecnico di Milano, Italy. He was Marie Curie Post-Doc Fellow with EU RTN Ultrasmooth at the University of Durham, United Kingdom, where he researched on the properties of nanoscaled films, stackings and multilayers for spintronics using x-ray scattering techniques, mainly with synchrotron light. He is currently permanent Research Engineer at the Institute for Microelectronics and Microsystems (IMM) of the National Research Council (CNR), Italy. His expertise is on the advanced structural and physico-chemical characterization of materials and structures at the nanoscale mainly using secondary ions mass spectrometry, X-ray photoelectron spectroscopy, Raman spectroscopy, X-ray reflectivity and X-ray diffraction. His current research interests include the study of 2D transition metal dichalcogenides, dielectric and piezoelectric materials in the framework of national and international research projects, also in strong collaboration with leader companies in microelectronics.