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Mechanically tunable strain fields in suspended graphene by micro electromechanical systems TYMOFIY KHODKOV, MATTHIAS GOLDSCHE, JENS SONNTAG, 2A Physik Institut, RWTH, Aachen, SVEN REICHARDT, Facult des Sciences, de la Technologie et de la Communication,Universit du Luxembourg, GERARD VERBIEST, 2A Physik Institut, RWTH, Aachen, STEPHAN TRELLENKAMP, Peter Grnberg Institute 9, FZ, Jlich, CHRISTOPH STAMPFER, 2A Physik Institut, RWTH, Aachen — The discovery of graphene triggered an enormous interest on the class of two-dimensional (2D) materials. 2D materials manifested high sensitivity of their thermal, optical or electric response to applied tensile stress. Therefore, a rigorous and systematic investigation of their mechanical properties is extremely important. On the example of graphene – a top candidate for future flexible electronic devices and sensors – we demonstrate fully controlled and restorable realization of various strain fields in 2D membranes by coupling them to Si-based electrostatic micro-actuators (comb-drives). The comb-drive actuators are capable to provide significant forces and they are made of highly-doped silicon, i.e. they can be operated down to cryogenic temperatures allowing the investigation of quantum effects in electromechanical systems. Using confocal Raman spectroscopy we characterize strain distribution in suspended mono- and bilayer graphene sheets under induced tension (up to 0.5%). A detailed analysis clearly show that graphene samples reproducibly experience strain in different directions only while applying voltages to the micro-actuator. This approach empowers accurate tuning of applied tension in any isolated 2D materials independent on other crucial parameters.

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