Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

A Correlation of Raman and Single and Multiple Layer Graphene Conductivity As Detected With A Cryogenic Multiprobe AFM With On-line Raman, NSOM and Other SPM Modalities AARON LEWIS, Hebrew University of Jerusalem, Benin School of Engineering & Applied Science, Jerusalem, Israel, OLEG ZINOVIEV, ANATOLY KOMISSAR, ERAN MAAYAN, DAVID LEWIS, Nanonics Imaging Ltd., Jerusalem, Israel — It is a challenge to study 2D materials, such as Graphene, MoS_2, $WeSe_2$, etc. at temperatures down to 10°K when considering the wide variety of physical phenomena that must be applied for a full picture of the functionality of these materials. This involves questions of structure, nanometric photoconductivity, electrical properties, thermal properties, near-field optical in the apertured & scattering modes, Kelvin probe, and Raman. These phenomena are common not only to 2D materials but also to carbon nanotubes and related nanomaterials. This presentation will describe the instrumental development of such a multiprobe cryogenic system that allows for state of the art on-line optical measurements and will also include a review of the probe developments that permit such multifunctional multiprobe operation with on-line full optical access. This system has a completely free optical axis from above and below not obscured by electrical or other probes that have been developed for multiprobe operation. This permits on-line Raman and Tip Enhanced NanoRaman Scattering. With such a system we have investigated graphene and HfO2 using multiprobe electrical, Kelvin probe, NSOM and on-line Raman. The results have yielded new insights into chemical changes correlated to electrical conductivity.

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Date submitted: 13 Nov 2014 Electronic form version 1.4