Determining the number of graphene layers based on Raman response of the SiC substrate

Mr. Jakub Jagiełło
Mr. Artur Dobrowolski, Mr. Jakub Jagiełło, Mr. Dariusz Czołak, Dr. Tymoteusz Ciuk,
Łukasiewicz Research Network – Institute of Microelectronics and Photonics, Aleja Lotników36/46, 02-668 Warsaw, Poland
jakub.jagiello@imif.lukasiewicz.gov.pl

In this presentation we demonstrate a method for direct determination of the number of layers of hydrogen-intercalated quasi-free-standing epitaxial Chemical Vapor Deposition graphene on semiinsulating vanadium-compensated on-axis 6H-SiC(0001). The method anticipates that the intensity of the substrate's Raman-active longitudinal optical *A1* mode at 964 cm^{-1} is attenuated by 2.3% each time the light passes through a single graphene layer. Normalized to its value in a graphene-free region, the A_1 mode relative intensity provides a greatly enhanced topographic image of graphene and points out to the number of its layers within the terraces and step edges, making the technique a reliable diagnostic tool for applied research. Raman spectra of graphene and the underlying SiC substrate were obtained in a backscattering geometry of the Renishaw inVia confocal microscope using the 532-nm (2.33 eV) line of a continuous-wave Nd:YAG laser and the Andor Newton CCD detector. The laser power was kept at 13.5 mW and the spot size was reduced to 0.3 µm. For possibly highest imaging resolution the lateral steps in both *X* and *Y* directions were set at 0.3 µm. In order to extract graphene spectra and the substrate response three types of 4624-point 20 µm × 20 µm maps were recorded. The authors believe that the protocol brings a reliable diagnostic tool for the quantification and comparison of graphene on SiC properties, thus accelerating research and development activities in the field of graphene-based applications.

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FIGURE

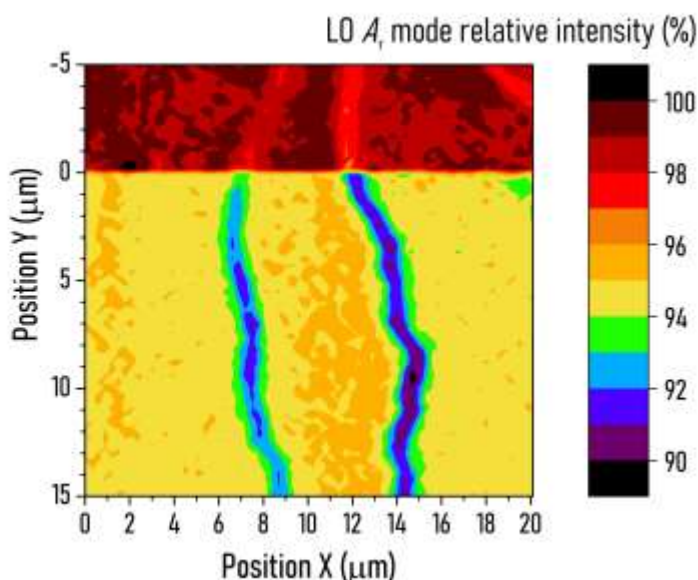

Figure 1: High-resolution Raman map of the 6H-SiC longitudinal optical (LO) A_1 mode relative intensity at 964 cm^{-1}.