Synthesis, investigation and sensing application of graphene grown by chemical vapor deposition

Filiberto Ricciardella

Universitaet der Bundeswehr Munich, Institute of Physics, Werner-Heisenberg-Weg 39, 85577 Neubiberg, Germany

Abstract

Graphene and other two-dimensional materials (2DMs) have triggered world-wide research interest in the last decade. The intriguing properties shown by 2DMs, such as high surface-to-volume ratio, high mobilities, high current on/off ratios, hold great potential for several applications. Particular attention has been devoted to the application of 2DMs at the gas sensing.

In this talk, I will show my latest results related to both synthesis and application of single and multi-layered graphene (SLG-MLG). As for the synthesis of the material, I have prevalently adopted chemical vapor deposition (CVD) on molybdenum catalyst substrate. I will present the footprint of SLG-MLG as being investigated through Raman spectroscopy, scanning and transmission electron microscopy (SEM-TEM) and other techniques. I will finally present the transfer-free process to overcome the transfer of SLG-MLG from the growth substrate to the target substrate.

As an application of the CVD-grown material, I will show the sensing properties of the devices, designed as chemi-resistors. The issues affecting these sensors, *i.e.* the lack of a steady-steady during the exposure and the scarce recovery, will be discussed. The developed approach to solve both issues will be introduced. The method, named as time-differential of signal output (TDSO), analyses the differential signal rather than the output of the sensor.

Finally, the strength and reliability of TDSO will be showed as applied to the chemi-resistors based on other 2DMs, such as platinum or tungsten diselenide ($PtSe_2$) and molybdenum disulfide (MoS_2) and grown by thermally assisted conversion.