Ultra-fast synthesis of Graphene on poly-crystalline metal foils

H. Lux[1], P. Siemroth[2], S. Schrader[1]

[1]Technical University of Applied Sciences Wildau, Hochschulring 1, 15745 Wildau, Germany
[2]Arc Precision GmbH, Schwartzkopffstraße 2, 15745 Wildau, Germany

Contact Mail: lux@th-wildau.de

Abstract

A new ultra-fast and stable process to deposit graphene on different metal substrates is presented. Polycrystalline copper and nickel foils can be used as well as thin metal layers on silicon wafers. In the process presented here, the substrate is heated up to 900°C and subsequently a magnetic filtered pulsed arc evaporation process [1] is used to deposit homogeneously a well-defined amount of carbon. The magnetic filter effectively reduces or prevents the deposition of droplets and provides a nearly particle-free and fully ionized carbon plasma. In contrast to all CVD and PE-CVD processes, the carbon source is limited by the number of arc pulses and therefore, the resulting thickness can be accurately predefined. Additionally, the growth conditions can be controlled by using different functional and/or inert gases (argon, hydrogen). Using this process, high quality graphene can be grown on metal foils in less than one minute. Furthermore, this process can be used for the formation of transparent and conductive Graphene-like carbon coatings on insulating substrates [2].
The coatings have been characterized using confocal Raman microscopy (Figures 1 and 2). It can easily be seen, that graphene homogeneously covers the polycrystalline copper foil without amorphous carbon segregation at the grain boundaries of the polycrystalline copper. The investigated area shows mainly a peak ratio typical for graphene with a low number of defects. Hence, the described fast growth process can pave the way to a fast and cost effective Graphene synthesis for mass production e.g. in roll-to-roll processes.

References

[1] H.-J. Scheibe et al., IEEE Transaction on Plasma Science, PS-25, 685 (1997)
[2] H. Lux et al., Journal of Applied Physics 117, 195304 (2015);

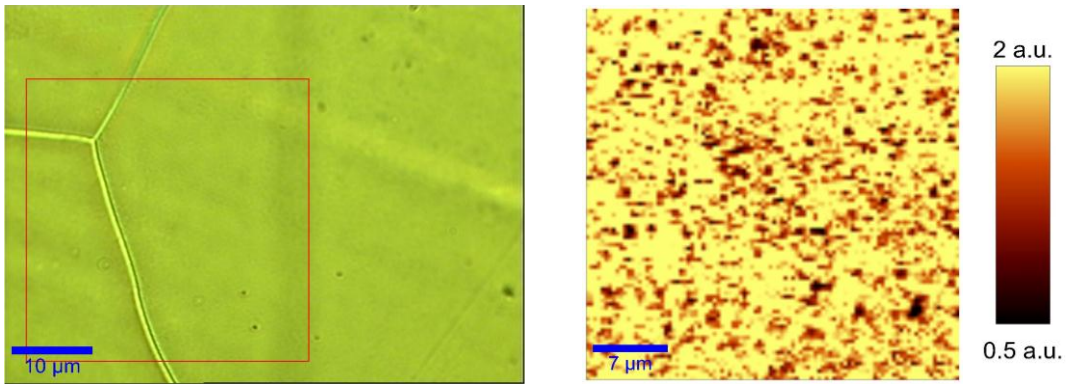

Figure1: Left side: Microscopic Image of a copper foil after graphene growth; right side: Raman Microscopic mapping image of the 2D/G ratio (cf. figure 2) of the left marked region.

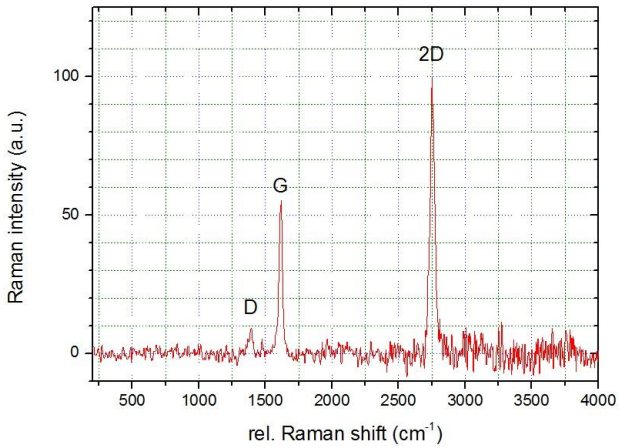

Figure2: Raman Spectrum of Graphene on Copper produced by means of magnetic filtered arc evaporation.