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Real-Time monitoring and kinetic studies of graphene growth on solid and liquid copper

C. Galiotis[1], M. Jankowski[2,3], M. Saedi[4], F. La Porta[3], A. C. Manikas[1], C. Tsakonas[1], J. S. Cingolani[5], M. Andersen[5], J. M. de Voogd[6], G. J. C. van Baarle[6], K. Reuter[5], , G. Renaud[2], O. Konovalov[3], I. M. N. Groot[6]

1 Dept. of Chem. Eng., University of Patras, and FORTH/ICE-HT, Patras 26504, Greece
2 Univ. Grenoble Alpes, CEA, IRIG/MEM/NRS 38000 Grenoble, France
3 ESRF−The European Synchrotron, 71 Avenue des Martyrs, 38043 Grenoble, France
4 Leiden Institute of Chemistry, Leiden University, P.O. Box 9502, 2300 RA Leiden, The Netherlands
5 Chair for Theoretical Chemistry and Catalysis Research Center, Technische Universität München, Lichtenbergstr 4, 85747 Garching, Germany
6 Leiden Probe Microscopy (LPM), Kenauweg 21, 2331 BA Leiden, The Netherlands
c.galiotis@iceht.forth.gr

Graphene is a perfect 2D crystal of covalently bonded carbon atoms and forms the basis of all graphitic structures with superior properties that can be exploited in many research areas. The synthesis of large, defect-free graphene is a major challenge towards industrial applications. Chemical Vapor Deposition (CVD) is the most well-known method of graphene growth. The growth process is rather complex, as it involves multiple reactions such as hydrocarbon decomposition, carbon adsorption and subsequently diffusion on the catalytic substrate the generation of the nucleation point and finally the growing. Chemical vapor deposition (CVD) on liquid metal catalysts (LMCats) is a recently developed method for the fast synthesis of high-quality single crystals of graphene. In contrast to a solid catalytic substrate, graphene growing on Liquid Metal Catalysts (LMCat) might be a solution for the production of defect-free single graphene domain at high synthesis speeds due to the enhanced atomic mobility, homogeneity, and fluidity of a LMCat. In-situ monitoring of such a complex procedure is of paramount importance for the control of graphene growth and the understanding of growing kinetics. However, up to now, the lack of *in situ* techniques enabling direct insight of the growth process has limited our understanding of the process dynamics and primarily led to empirical growth recipes. Therefore, *in-situ* monitoring of the graphene growth, coupled with a real-time control of the growth parameters, is necessary for efficient synthesis. Herein, we report on the development of a real time monitoring of graphene growth via in situ reflectometer for the case of graphene grown on solid and via in situ optical microscopy, Raman spectroscopy and X-Ray diffraction for graphene grown on liquid metal substrates.

References

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