Recent Advances of Graphene Growth by CVD on Solid and Liquid Catalysts

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2D materials (2DMs) have now been established as unique and attractive alternatives to replace current technological materials in a number of applications. The synthesis of large, defect-free two-dimensional materials (2DMs) such as graphene is a major challenge toward industrial applications Chemical vapour deposition (CVD), is undoubtedly the most renowned technique for thin film synthesis and meets all requirements for automated largescale production of 2DMs. 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. Currently most CVD methods employ solid metal catalysts (SMCat) for the growth of 2DMs however their use has been found to induce structural defects such as wrinkles, fissures, and grain boundaries among others. 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. Real-time monitoring of such a complex process is of paramount importance for the control of graphene growth and the understanding of growing kinetics. Nevertheless, the lack of in situ techniques enabling direct observation of the growth process has limited our understanding of the process dynamics and primarily led to empirical growth recipes. 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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