Max-Planck-Institut für Struktur und Dynamik der Materie

Max Planck Institute for the Structure and Dynamics of Matter

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CFEL Seminar room V (Bldg. 99)


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## Growth Dynamics of Graphene on molten copper

Since it's discovery in 2006, Graphene has known no rivals in terms of number of applications that scientists from all over the globe have thought for him, ranging from spintronics to energy storage, from transistors to bio-compatible devices. However, what's still hindering his big step from laboratories to industry is a cost-effective method to synthesize large-scale good-quality crystals.

Over the past decade, great improvements have been made in this direction, and CVD consolidated as an excellent candidate for this arduous task. Among other methods, a novel technique consisting in the synthesis of crystals on transition metals in the liquid phase has proven to overcome many difficulties related to defect-inducing dislocations and low-diffusivity of solid substrates. Nevertheless, a clear physical insight over the processes involved during graphene nucleation and growth is still lacking, and many of its parameters are derived by post-process analyses, neglecting those crucial intermediate steps that may conceal key-factors involved in the process. The reason for this trend is that it's technically difficult to combine different experimental set-ups, and an ad-hoc design is more than ever needed to conduct a complete and satisfying investigation.

This is the reason behind the LMCat project, that developed a reactor suitable both for CVD growth at high temperature by hydrocarbon decomposition and for in-situ Raman and optical studies, in order to follow in real time the growth of graphene flakes and, at the same time, determine its physical properties. Additionally, it aims to prove X-ray techniques, such as GID and XRR, as an efficient tool for high temperature characterization, a feat never achieved before. This is the framework of this thesis work, which can of course cover it only partially and at a rather early stage. The focus has been put on the surprising high contrast showed by radiative optical microscopy at high temperatures (~ 1100 C°) and on the first, surprising results coming from X-ray analysis. The former has been proven as an effective tool for following the growth and derive kinematical parameters, the latter as a potential tool for quantitatively estimate its crystal structure at conditions prohibitive for standard probes.

Host: Daniele Nicoletti / Andrea Cavalleri

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