Novel synthetic approaches for high-mobility graphene: from decoupled graphene on Cu/sapphire to artificial intelligence assisted growth

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The scalable synthesis of graphene over flat and rigid templates – displaying quality comparable to that of mechanically exfoliated crystals – has become a central topic in the last years, as it would enable several high-end applications, scalable twistronic devices, and pave the way to enticing quantum technologies. In this talk, I will introduce the growth via non-reducing chemical vapor deposition (CVD) of decoupled graphene on crystalline Cu films deposited on sapphire. The resulting graphene is lying atop a thin Cu2O layer, and is charge neutral, low strained, and easy to transfer. Electrical transport measurements reveal unprecedented room temperature carrier mobilities for graphene grown on rigid substrates, exceeding 105 cm2 V−1 s−1 upon encapsulation in hexagonal boron nitride [1], thus opening realistic pathways for graphene-based high-end applications, including the exploration of innovative quantum platforms. Concerning the adoption of CVD graphene in twistronics, I will introduce new findings in CVD large-angle-twisted multilayer graphene [2]. Finally, I will discuss the transformative potential of artificial intelligence (AI) in materials science by demonstrating artificial neural network (ANN) assisted growth of high-quality graphene [3].

References

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[2] A. Boschi, Z.M. Gebeyehu, S. Slizovskiy, V. Mišeikis, S. Forti, A. Rossi, K. Watanabe, T. Taniguchi, F. Beltram, V.I. Fal'ko, C. Coletti, S. Pezzini, submitted.
[3] Sabattini et al., in preparation