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AUGUST 31 - SEPTEMBER 03, 2021 ● BOLOGNA, ITALY
EUROPEAN CONFERENCE ON CHEMISTRY OF TWO-DIMENSIONAL MATERIALS

Scalable high-mobility graphene/hBN heterostructure

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The high-mobility of graphene can be exploited in several applications, from high-frequency electronics to photonics and opto-electronics[1]. Chemical vapour deposition (CVD)-grown graphene has proved to perform in pair with the highest quality exfoliated flakes, when integrated into heterostructures with hexagonal Boron Nitride(h-BN)[2]. In this framework, the research of a growth method of h-BN that is scalable and suitable for integration with graphene and TMDs heterostructures is very active[3].

Here we present the realization of graphene/h-BN heterostructures with scalable techniques. h-BN continuous films were grown by Ion Bean Assisted Deposition (IBAD)[4] directly on Si/SiO_2 substrate. Atomic force microscopy (AFM) analysis reveals the atomic flatness of the material (Fig. 1a and 1b). High-quality graphene single-crystal arrays were grown by CVD[5] on copper and transferred on the target h-BN using a semi-dry approach. Raman spectroscopy reveals a reduction in the graphene strain on h-BN. The residual carrier density is in the range between $8X10^{10}$ cm^{-2} and $20x10^{10}$ cm^{-2}, and carrier mobilities around 10000 cm^2/Vs (Fig. 1c) , in ambient condition.

This work represents a first step toward the realization of high-mobility graphene/based scalable devices. The quality of the presented scalable heterostack paves the way to the implementation of high-performing devices in electronics and opto-electronics applications.

References

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Figures

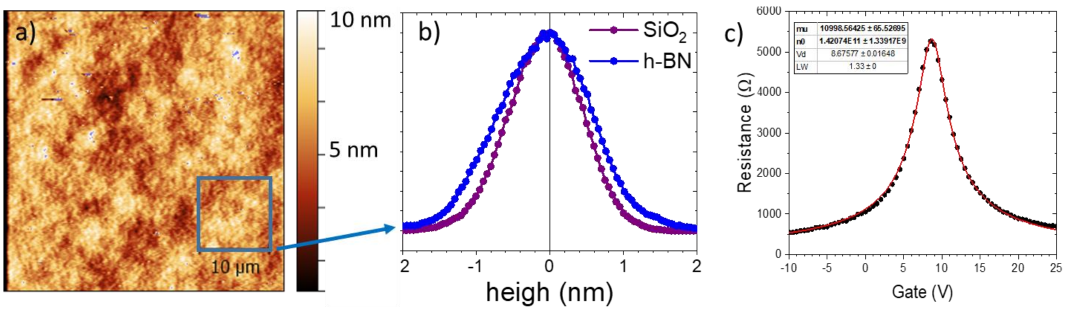

Figure 1: a) AFM characterization of the pristine h-BN film. b) Height distribution on an area of 100 μm^2 on h-BN and on SiO_2. c) Electrical characterization of the graphene on h-BN performed in ambient condition, with mobility of 10 000 cm^2/Vs and $n_0 = 1.5X10^{11} cm^{-2}$.

Acknowledgments

This project has received funding from the European Union's Horizon 2020 research and innovation programme Graphene Flagship under grant agreement No 881603-GrapheneCore3.