Transfer and interface characterization of 2D materials for microelectronic devices

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Abstract: 2D materials have attracted a lot of attention since the last decade due to their unique properties especially in the microelectronics field [1]. However thermal budgets engaged for the synthesis of high quality 2D materials are, most of the time, not compatible for the direct growth into device structures. Therefore, transferring synthesized layers from the growth substrate to a desired one is required for functional device fabrication [2]. However, the transfer process could modify or degrade the material properties, and the quality of interface between the transferred materials and the targeted substrates should be carefully controled to achieve the expected properties. [3]

Our work focuses on the development of a clean room compatible large-scale transfer process based on spalling method for its integration into microelectronic devices such as photonics, RF switches or memories.

We report here a physico-chemical characterization of 2D layers before and after transfer using microscope SEM and TEM, AFM, XPS and Raman spectroscopy to study the impact of our transfer process. The electrical properties are also studied using four probes and Van Der Pauw measurement after transfer to verify the electrical interface while optimizing the process to get a good copy of the as grown materials by keeping the growth interface safe from solvent or other impurities.

References

[1] Wu, M, Xiao, Y, Zeng, Y, et al. *InfoMat*. 2021; 3: 362– 396
[2] Shim et al., Science 362, (2018) 665–670
[3] Yuan Liu, Xidong Duan, Hyeon-Jin Shin, Seongjun Park, Yu Huang & Xiangfeng Duan, Nature | Vol 591 | 4 March 2021

Figures

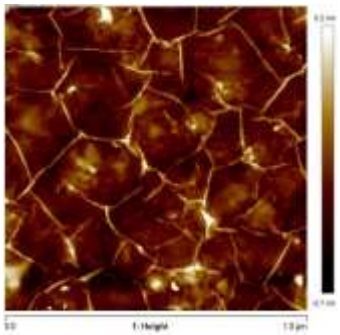

Figure 1: Atomic force microscopy of h-BN from Aixtron