Mono and Multilayer Silicene Filed-Effect Transistors

E. Cinquanta[1], C. Grazianetti[1], L. Tao[2], P. De Padova[3], C. Quaresima[3], C. Ottaviani[3], B. Olivieri[4], D. Akinwande[2], and A. Molle[1]

1 Laboratorio MDM, IMM-CNR, via C. Olivetti 2, Agrate Brianza, I-20864, Italy
2 Microelectronics Research Centre, The University of Texas at Austin, TX-78758, USA
3 ISM-CNR, Via Fosso del Cavaliere 100, Roma, I-00133, Italy
4 ISM-ISAC, Via Fosso del Cavaliere 100, Roma, I-00133, Italy
eugenio.cinquanta@mdm.imm.cnr.it

Abstract

Recently, the integration of silicene [1] in a field-effect transistor (FET) [2] attracted huge interest thus representing an intriguing option to overcome the scaling issues in the nanoelectronics field and being, at the same time, fully compatible with the current ubiquitous semiconductor technology. Therefore, the study of Si thin films at the two-dimensional (2D) limit is highly demanded in order to understand either structural or electronic properties. In particular, multilayer silicene on Ag(111) [3] might represent an advance with respect to the monolayer because of its weaker interaction with the Ag substrate at the bottom and a higher stability towards air exposure on top. Hence, we report here on the comparison between multilayer silicene films grown at different substrate temperature regimes. By means of Raman spectroscopy, a clear trend of the E_{2g} mode is found out pointing towards bulk-Si condition as the substrate temperature is increased. Moreover, the realization of multilayer silicene FETs allowed for discriminating an ambipolar behavior from a trivially one as a function of the Si growth temperature [3]. These outcomes show that the structural and electronic properties of Si at the 2D limit can be successfully manipulated through carefully tuning the growth conditions, paving the way to an advanced control of Si properties at the nanoscale.

References

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