Processing 2D Materials: From synthesis to devices

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Abstract

The reduction of dimensionality has revealed exciting electronic behavior of 2D materials such as graphene and transition metal dichalcogenides. In order to successfully exploit those techniques synthesis on an industrial scale and integration into functional devices must be developed. In this talk examples for the fabrication of hybrid electric devices with films produced by scalable CVD synthesis are presented. Namely, diodes were fabricated by transferring large area functional 2D layers onto pre-patterned silicon substrates.[1, 2,] Monolayer graphene diodes, in particular, serve as a platform for a new type of chemical sensor.[1, 4] Exposure to a range chemicals alternated the conductivity and ideality factor of these devices by doping the graphene layer reversibly. Furthermore, p-n heterojunction diodes between MoS_2 and p-Si where fabricated.[3, 4] These devices exhibited impressive photoconductivity displaying a broad spectral response with an extended range in the visible region. Our approach of integrating novel 2D materials with traditional silicon technology represents a significant step towards scalable fabrication of devices and opens up a wide range of novel functionalities of the achieved heterostacks.

References

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[2]. Yim, C.; McEvoy, N.; Rezvani, E.; Kumar, S.; Duesberg, G. S. *Small* **2012,** 8, (9), 1360-1364.
[3] Lee, K.; Gatensby, R.; McEvoy, N.; Hallam, T.; Duesberg, G. S. *Advanced Materials %@ 1521-4095* **2013**.
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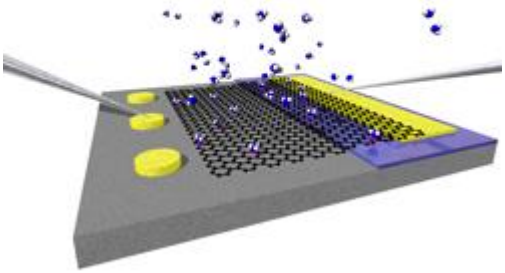
Figure



Schematic Silicon-Graphene Diode for Chemical Sensing