Unveiling the tunneling phenomena in graphene-graphene homojunctions for emerging device applications

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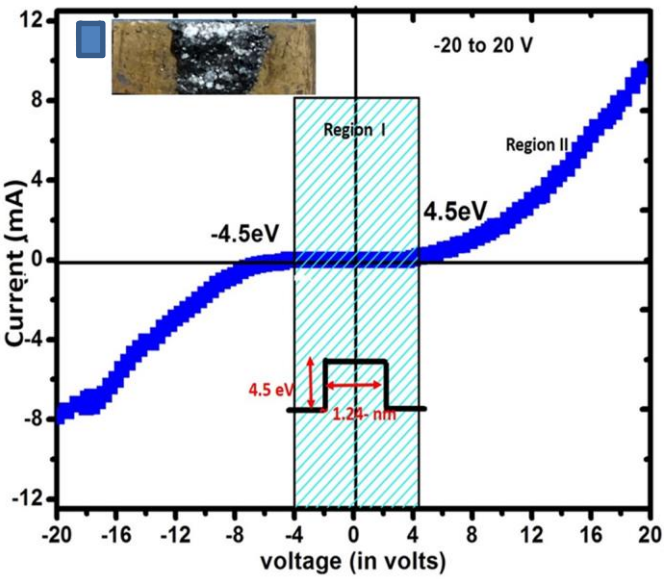
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Abstract (300 word limit)

Graphene, the 2D form of carbon based material exists as a mono layer arrangement of atoms in a honeycomb lattice, has sparked the science and technology sectors in view of its astonishing electrical and thermal properties, together with its elasticity and mechanical strength.

Motivated by the idea that high-quality graphene always produces innovative aspects of physics. In this outline, a novel class of two dimensional (2D) assembly namely thickness controlled homo-junctions with a configuration similar to graphene–insulator-graphene is introduced in this work. We demonstrate 2D-2D quantum tunneling between two graphene stacks in which van der Waals gap serves the purpose of tunneling barrier. The nonlinear I-V characteristics with improved current switching ratio (I_{on}/I_{off}) of ~10^6 coupled with counterclockwise current hysteresis which are the signatures of a memristive devices has been validated in the tunneling regime. It is the first time to report on revealing thickness modulated 2D homo junctions in exfoliated graphenic material and to disclose the involved tunneling mechanism for switching applications. This work promises well for the possibilities of graphene sheets for the realization of two terminal configured devices as a substitute of three terminal graphene based field effect transistors (GFETs) in the area of resistive switching memories. As graphene being a versatile candidate possessing durable future in nano-electronics, therefore understanding deep insights of its charge carrier transport mechanism under range of bias voltages is prerequisite. Strikingly, an unconventional approach for improving on/off ratio of graphene based resistive switching devices has been put forward.

Image



I–V characteristics of exfoliated graphene based device from −20 to 20 V (device is shown in inset)

Recent Publications (minimum 5)

1.Amanpreet Kaur and Ravi Chand Singh (2019) Journal of Physics: Condensed matter (31(47):475303: doi: 10.1088/1361-648X/ab3997).

2. **Amanpreet Kaur** and Ravi Chand Singh **(2019)**, Journal of Material Science: Materials in electronics 30:5791–5807

3. **Amanpreet Kaur** and Ravi Chand Singh **(2019)**, *AIP Conference Proceedings* **2142**, 160007.

4. **Amanpreet Kaur**, Jasmeet Kaur & Ravi Chand Singh **(2018)**, Materials Research Express, 5, 085601, 1-14.

5. **Amanpreet Kaur,** Jasmeet Kaur & Ravi Chand Singh **(2018)** *Sensors and Actuators A*, Physical, 282, 97–113.

Biography (150 word limit)

Dr Amanpreet Kaur received her Ph.D. in Physics from Guru Nanak Dev University, Amritsar, India in 2020. Her research interests are focused on “Exploration of exfoliation strategies for graphene nanosheets and device applications thereof”. She has contributed eco-friendly methods for delamination of stacked 2D sheets i.e. graphene sheets from graphite, their in-depth characterization and followed by their transfer to solid substrates for the investigation towards gas sensors, temperature sensors, conductive inks, fabrication of 2D homojunctions for resistive memories and hydrogen storage applications. She has published abundant of research papers in international journals of repute. Besides, she has also presented various papers at different international conferences and summer schools. She has won a series of competitive awards to fund her own travel grants. In addition, she is an active mobile researcher and has also attended European school on Nano-sciences and Nanotechnologies (ESONN 2017) under CEFIPRA-ESONN fellowship, 2017 at Grenoble, France. She was nominated by Govt. of India amongst eight doctoral students all over India for attending ESONN-2017. She has also been awarded as “Young Scientist award” 2018 by Punjab academy of Sciences, India. She has “Best oral presentation award” to her credit.

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