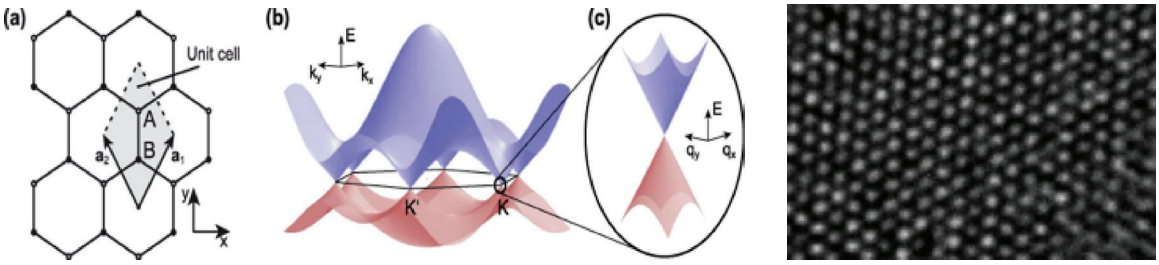
Stanene: A story beyond graphene

The discovery of graphene by Prof. Andre Geim and Prof. Kostya Novoselov in 2004 at the University of Manchester, UK, changed completely the perception of materials in general. This being considered as one of the outstanding scientific contributions of the century, enabled them to earn the Nobel prize in Physics, shortly after in the year of 2010. Since then graphene has become a buzz word and found numerous applications ranging from fundamental science to virtually all aspects of engineering including biosciences and engineering.

One of the unique properties of this 2D honeycomb lattice - Fig. (a), which made it exceptional, was the presence of 'Dirac' point in the E-K dispersion as shown in Fig. (b). A zoomed image of the Dirac point is shown in Fig. (c). Images (a-c) inherited from *Rep. Prog. Phys. 75 126502 (2012).*

The presence of the linear conical dispersion at low energies enables the electrons and holes near these K points to behave relativistically. This provides graphene, all its exotic electronic properties. The fact that the Hall conductance is quantised to a ratio of fundamental constants multiplied by an integer ν, enabled in establishing a deeper connection between the quantum Hall effect and topologically non-trivial insulators. Albeit its interesting electronic properties; weak spin-orbit (SO) coupling in graphene limits its applications as futuristic spintronic devices, topological insulators, etc. The SO coupling in stanene is just sufficient to open up a SO gap at the in the electronic band structure enabling it to be labelled as a room temperature topological insulator.



At our Nanostructures Engineering and MOdeling (NEMO) Laboratory, a team of researchers has been successful in synthesising free standing stanene, cousin of graphene, for the first time in year 2016 [*Scientific Reports 6, 31073 (2016), Nanotechnology 27, 495701 (2016)*]. The samples were characterised using various optical techniques including UV-Vis absorption spectroscopy, Raman spectroscopy. The experimental data was found to be in corroboration with the calculated spectrum for low-buckled sheet of stanene which is the most stable configuration verified experimentally in the later reports published by Zhang group at Stanford University.

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