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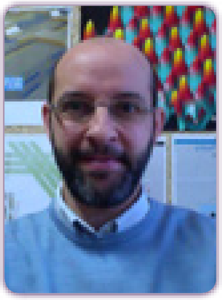

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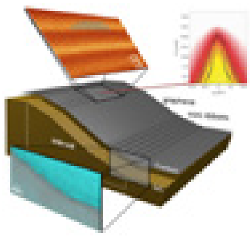
Gap opening and tailoring of graphene band structure

The disadvantage of graphene for using digital electronics is lack of bandgap, which is necessary to perform on-off switching operations in transistors. We have shown three different approaches to open a gap in graphene and tailor its electronic band structure. This includes (1) nanostructuration of graphene into graphene nanoribbons, (2) preparing a well-ordered buffer layer graphene and (3) introduction of a super-periodic potential in graphene grown on vicinal noble metal substrates. In our first approach to control graphene band structure, we have considered graphene ribbons grown on facets of the SiC (0001) surface. Our morphological characterization by scanning tunneling microscope (STM) and cross sectional transmission electron microscope (TEM) shows the presence of mini-ribbons bordering a central extended ribbon. These mini-ribbons have a width of 1-2 nm and promote an electronic confinement gap of more than 0.5eV as observed by photoemission, in an otherwise decoupled graphene from the substrate. We have also studied the first stages of graphene growth. On SiC (0001) substrate, under adequate growth conditions, a well ordered first single layer graphene (i.e. the buffer layer) exhibits again a bandgap of more than 0.5eV. The origin of this bandgap was unclear, so we used STM, TEM angle-resolved photoemission spectroscopy (ARPES) together with calculations. This comprehensive study demonstrated that the bandgap opening is due to the super periodicity induced by the substrate. Finally, we induced different super-periodicities on the underlying substrate to tailor graphene's electronic properties. The nanostructuration of two substrates, Ir(332) and a multivicinal curved Pt(111) substrate induces a superperiodic potential on graphene that opens mini-gaps on the π band as observed by ARPES and consistent with the structural periodicity observed in STM and low energy electron diffraction.



Biography

Antonio Tejeda is a Researcher at CNRS, the main French Research Center. He has obtained a tenured position at CNRS in 2004 and currently works in the Laboratoire de Physique des Solides. His areas of expertise are low dimensional systems, surfaces and interfaces, especially correlated surfaces and graphene. He often combines structural techniques and electronic spectroscopies, mainly scanning tunneling microscopy and high-resolution angle resolved photoemission. He is responsible as the Chair of the International Symposium on Graphene Devices- 2012, the edition of a special issue J. Phys. D: Appl. Phys on Graphene: From functionalization to devices and another J. Phys.: Condens. Matter on "Correlation and many-body effects at surfaces". He has also written the book "Photoemission in Solids: Concepts and Applications".

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