Open postdoctoral position at Université Paris Cité
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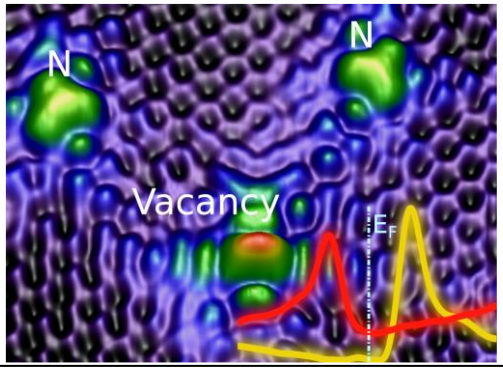
Controlling the properties of 2D materials by defect engineering and atomic scale characterization by scanning tunneling microscopy

The isolation of graphene in 2004 led to the rise of the field of layered two-dimensional (2D) materials. In all 2D materials, imperfections are unavoidable, they can alter the performances of materials, but also can be used to improve them. Such imperfections, e.g., vacancies or substitutional/intercalated atoms etc., when combined with the low-dimensionality and enhanced surface/volume ratio, can in principle be engineered to give desirable properties such as reactive catalytic sites, or enhanced transport properties. In this context, defect engineering has recently emerged as a promising strategy to tune the properties of 2D materials.

In this project, we will use scanning tunneling microscopy and spectroscopy (STM/STS) operating under ultra-high vacuum and at low temperature to study the structure and electronic properties of generated defects in 2D materials at the atomic scale. Substitutional atoms (such as nitrogen in graphene), vacancies and other defects will be used to tune the properties of the materials in order to reach new functionalities (see Figure). The impact of defects on the density of states will be investigated at the atomic scale by STM/STS. The interaction of defect sites with adsorbed molecules will be probed as well to reveal the impact of the defects on the chemical activity. Ab-initio calculations will be utilized to provide insight into the experimental outcomes.

The candidate must have a good knowledge and practice of scanning tunneling microscopy in ultrahigh vacuum. A background in ab initio calculations will be appreciated.

The starting of the position will be during the year 2024 for a duration of up to 18 months.



Combination of vacancies and nitrogen in graphite to tune the resonant states of vacancies from unoccupied states in undoped graphite, to occupied state in nitrogen doped graphite.

D. Demba et al., Chem. Phys. Chem. (2024)