Tunable electronic structure of pure and doped graphene

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It is well-known that the most outstanding properties of graphene are related to its Dirac spectrum of electronic states at the Fermi level. Thus, control of the electronic bands is a key for tuning the properties of graphene-based materials. This lecture will uncover various approaches for the purposeful modifications of the graphene electronic structure and properties. The basic idea relies on a fact that the electronic states of graphene are strongly influenced by various factors, such as a contact with other materials or a presence of defects and embedded impurities. This opens wide opportunities for controlling such properties as the width of a band gap, the type and concentration of charge carriers, and other characteristics required for practical applications.

A powerful method for the study of electronic states of materials is a photoelectron spectroscopy with angular and spin resolution. It is particularly efficient for the study of 2D materials, including graphene. This method allows monitoring of the changes in the electronic structure of graphene influenced by interaction with the substrate, incorporation of impurities, adsorption and functionalization [1-3]. It will be demonstrated how the combination of photoemission with other methods like scanning tunneling microscopy and spectroscopy, electron and photoelectron diffraction, X-ray absorption spectroscopy, Raman spectroscopy and DFT simulations allows deep insight into the structure and electronic properties of pure and doped graphene layers on different surfaces.

References

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