Second generation graphene: Opportunities and challenges for surface science

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Second generation graphene: opportunities and challenges for surface science[1]

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Abstract

Graphene is an extremely intriguing material that is arousing a formidable amount of interest in many different disciplines. Surface science has not been immune to this fascination and has quickly made its contribution to the synthesis and study of the fundamental properties of systems like epitaxial graphene films, nanoribbons, nanopatches, providing a basic knowledge, which has been successfully capitalized upon by technologists and material scientists.

Nowadays, the focus of scientists' attention has moved towards more complex systems like chemically modified graphene and 3D systems based on the assembly of graphene sheets. However, despite many successful applications and the synthesis of very different materials, a basic understanding of the phenomena taking place at the atomic level is still missing, as is a clear correlation between structure and properties. Surface science, by virtue of its reductionist approach, can certainly make an important contribution to these new branches of research. Graphene is a perfect candidate for the realization of highly controlled model systems, in which to study the evolution from 2D to 3D topology or the new properties engendered by the substitution of carbon atoms with selected heteroatoms or entire functional groups.

Graphene has also proved to be an effective and versatile support: by acting on the nanostructure

[1] **Acronyms**

AFM	atomic force microscopy
ARPES	angular resolved photoemission spectroscopy
CMG	chemically modified graphene
CVD	chemical vapour deposition
DFT	density functional theory
EC	electrochemical, electrochemistry
EC-SS	electrochemical surface science
GO	graphene oxide
N-G	N-modified graphene
3DG	3D graphene
NP	nanoparticle
ORR	oxygen reduction reaction
r-GO	reduced GO
STM	scanning tunneling microscopy
TPD	thermal programmed desorption
UHV	ultra-high-vacuum