PHOTOCHEMISTRY AND NANOPOROUS CARBONS: PERSPECTIVES AND CHALLENGES TOWARDS NEW MATERIALS AND APPLICATIONS

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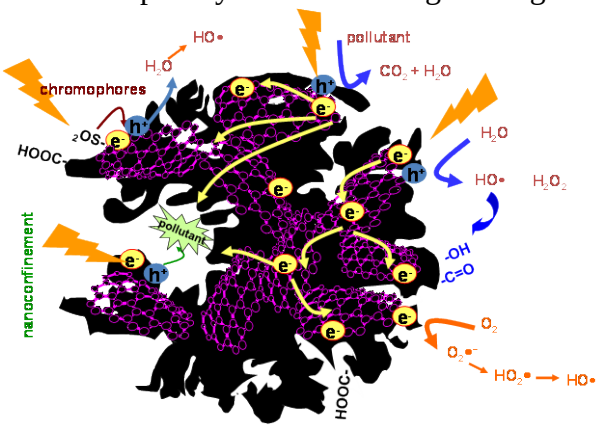
Carbon-based materials are versatile solids with a variety of forms, architectures and composition that are at the forefront of nanotechnology in many science and engineering fields. Such versatility stands from the flexible coordination chemistry of carbon atoms and their ability to bind other heteroatoms either on the surface or inserted within the structural framework, resulting in a wide spectrum of materials and allotropic forms that display very different properties (conductivity, electron mobility, surface reactivity, crystallographic order, nanoporosity, hydrophobicity, wettability). Recent advances on material's chemistry have contributed to develop highly featured carbons that offer unexpected opportunities in multidisciplinary science and engineering fields beyond traditional uses.



In this context, our recent work has provided the proof of the concept of the photochemical activity of metal-free nanoporous carbons under UV and visible light irradiation, as well as the first experimental evidence on their ability to generate reactive radical species when exposed to light in aqueous environments.

The aim of this lecture is to review the recent progress on the application of nanoporous carbons in photochemical applications using varied illumination conditions (UV, simulated solar light) covering: i) photocatalytic degradation of pollutants (where the carbon material has a dual role as photocatalyst and adsorbent for simultaneously promoting the degradation of the pollutant and the regeneration of the carbon); ii) perspectives on the use of photoactive carbons as additives to semiconductors in the fabrication of electrodes for the photoelectrochemical conversion of energy; iii) the formulation of self-cleaning paints for indoor applications; iv) the use of novel light-induced reactions for the preparation of high performing nanoporous carbons with great design flexibility. The key role of carbon matrices coupled to all types of photoactive materials will be discussed, describing the photochemical quantum yield for different reactions, and discussing the mechanisms postulated for the carbon/light interactions in confined nanopore spaces.