Towards electroactive carbon nanoforms: chemical modification and propeties

Laura Rodríguez-Pérez,[1] Raúl García,[1] Jaime Mateos-Gil,[1] Mª Ángeles Herranz,[1] Nazario Martín[1,2]

[1]Organic Molecular Materials Group, Organic Chemistry Department, Complutense University of Madrid, 28040 Madrid, Spain. [2]IMDEA Nanoscience, Cantoblanco Campus, 28049 Madrid, Spain.
laura.rodriguez.perez@quim.ucm.es

Abstract

Since the discovery of fullerenes, the hollow cylindrical multiple and single wall carbon nanotubes (SWCNTs) and, more recently, the one atom thick layer sheet of graphite known as graphene, the research on different carbon nanoforms has attracted the attention of the scientific community in all fields and has been in continuous evolution. Among carbon nanostructures, SWCNTs and graphene present outstanding mechanical and electronic properties and their versatility as integrative building blocks in electron-donor-acceptor structures is an important issue to be considered for the preparation of optoelectronic devices.[1]

However, for pursuing practical applications, one major drawback is the difficult processability and/or dispersibility of these nanoforms of carbon, which decrease the overall yields of usable material and interfere with most of their desired properties. So, the chemical functionalization is the required first step in order to have materials easy to be handled. Two strategies are generally used: *i)* the supramolecular modification relies on interactions that are affected by many parameters (concentration, solvent,..) but has the advantage of preserving the electronic structure. In contrast,.*ii)* the covalent modification of SWCNTs and graphene can alter their inherent properties if it is not controlled, but the improving in the stability of the nanoconjugates makes it suitable for practical applications.[2]

Carbon nanostructures are good electron-acceptor, which have been combined with donors of different nature. In this regard, the remarkable gain of aromaticity and planarity that π-extended TTF (exTTF) derivatives reveals upon oxidation renders them an interesting donor unit that has been extensively used in the preparation of different donor-acceptor ensembles.[3] Interestingly, the electron-donor character of SWCNTs and graphene has been scarcely explored. Good electron-acceptor systems are those based on tetracyanoanthraquinodimethane derivatives (TCAQ), which have been investigated with respect to their charge-transfer interactions with conjugated polymers and fullerenes.[4]

In the present work, we will present our recent results on the covalent and supramolecular functionalization of SWCNTs and graphene with exTTF electron-donors or TCAQ electron-acceptor moieties (Figure 1). The synthesis and characterization of the new nanostructures will be discussed in detail.

References

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Figure

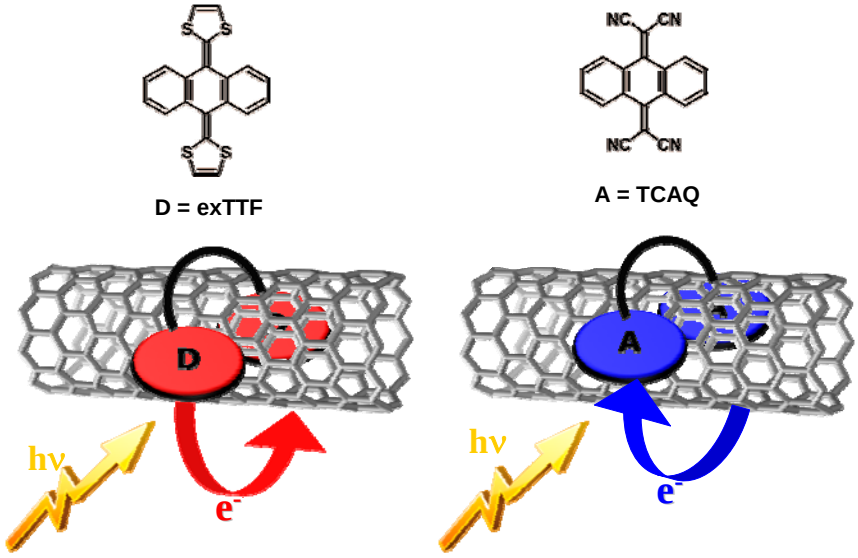

Figure 1. Supramolecular modification of SWCNTs with electron-donor (exTTF) and electron-acceptor (TCAQ) molecules.