Solar Energy Harvesting on S- and N-doped Nanoporous Carbons

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Nowadays heteroatom-containing carbonaceous materials such as graphene or CNT have gained more and more attention of the scientists searching for inexpensive substitutes of the catalysts for energy related applications such an oxygen reduction reactions.

Discovery of graphene and an extensive characterization of its electronic properties caused that the surface of traditional activated carbon has been viewed from other, unexplored before, angles. The main advantage of activated or nanoporous carbons, within the family of carbonaceous materials, is their porosity where the confined pore space effect can be utilized.

Recently we have shown that specific nanoporous carbons obtained from commodity polymers can catalyze oxygen evolution reactions[1], oxygen reduction reaction[2] and exhibit photoluminescence properties[3]. This behavior was attributed to the specificity of surface microstructure, texture, and chemistry. It was found that the carbons obtained at relatively low temperature (800 ^{o}C) contain 10 nm graphic units enhancing their DC conductivity. They have also rich surface chemistry based on sulfur, nitrogen and oxygen containing groups. Even though small sp^2 clusters should be important to affect the width of the band gap, the sulfur and nitrogen containing groups are hypothesized to act as chromophores/antenna accepting visible light energy. Electron deficiency on them promotes water splitting in small pores. These groups also change the electronic structure of the carbons surface and bring some level hydrophobicity to it. These features were found as important for oxygen reduction reactions[4]. These reactions enhance the performance of carbons as supercapcitors when the process takes place in the visible light[5].

References

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