Light-induced modifications of nanoporous carbons

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The use of nanoporous carbons as catalysts in photochemical reactions has become an interesting topic that has opened new opportunities for these materials in various disciplines related to light harvesting and applied photochemistry in nanoconfined systems. The dependence of the photochemical activity of nanoporous carbons with the pore confinement and the surface chemistry has been demonstrated, and the challenge is yet to design sustainable metal-free nanoporous carbons with optimized features at different levels (multimodal pore control at the nanometric level and surface functionalization) so as to boost their response under solar light. Following this, we observed the occurrence of photocorrosion reactions on highly functionalized carbons after long illumination periods, giving rise to the consumption of the carbons' photoactive sites and to charge transfer limitations.

To further clarify the issue of photocorrosion, we have investigated nanoporous carbon materials with different surface functionalization (i.e, low and high), exploring their ability to photocatalyze the oxidation of water and the extent of surface photocorrosion due to the long-term light exposure. Two different light configurations were used to isolate the effect of the irradiation wavelength (UV and visible light) on the textural and chemical features of the carbon photoanode, and its long-term photocatalytic performance for the oxygen evolution reaction.

An extensive surface and textural characterization after illumination showed different photocorrosion patterns for the carbons of low and high functionalization. The photoinduced modifications in the textural, chemical and structural features were linked to the effect of the irradiation wavelength and the deactivation of the anodes.

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References

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