Reactivity of the photoexcited states of carbon materials with different structural features

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Understanding the photochemical activity of different carbon materials has become an interesting topic with new perspectives in the field of metal-free photoactive materials for energy conversion, environmental remediation, and sensing applications. Due to the inherent complexity of certain carbon-based systems (e.g., amorphous and nanoporous carbons), the underlying mechanisms governing the carbon photoinduced reactions and the fate of the photoexcited states of the carbon atoms are still not well-understood.
In this study we have investigated the origin and the reactivity of the transient species generated upon irradiation of various carbon materials with different chemical composition, porosity and order. By using time-resolved absorption, photoluminescence paramagnetic resonance spectroscopies we have evaluated the photosensitizer nature of various carbon materials exposed to different irradiation conditions. The occurrence of intermolecular photochemical conversions depended on the illumination conditions, demonstrating the stabilization of electrons and holes trapped in different environments, as well as direct charge transfer in the presence of holes and/or electron scavengers.