Nanostructured surfaces

The impact of carbon surface functionalization on absorptive nonlinear optical response under pulsed excitation at 1064 nm

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Nanoporous carbons that including graphite-like nm constituents, have open edges adopting a non-bonding π-electron state. Located at the degenerate point between the graphitic - and *-bands, it plays a role of the electron reservoir. The population of the state of edge origin determines electro-optic/magnetic properties of such carbons. Both fluorination and alkyl-fluorination effect on their properties through the downshift of the Fermi energy. The fluorine-functionalized carbons with a flexible 3-D random disordered network can be involved in the production of interfaces for optoelectronic and optical limiting use. For the uncovering of the fluorination rules, we chose nanoporous activated carbons as a model since they disordered networks are formed by graphite-like domains consisting of stacked nanographene layers (NGL). Thermal analysis, ATR, XPS, and MASS-NMR reveal the functionalization of carbons. From the chemical analysis, the fluorination gives up to 2.5 mmol×g^{-1} of F-containing groups. The chemisorption caused the formation of covalent C–F bonds, inside the nm scaled pores, mainly at the edges of NGL. This functionalization has an effect on the conjugate NGL - electronic structure induces the charging and structural effects; moreover, the election states mixing with fluorine could produce a significant impact at the open edges periphery, on the edge-states spins. The surface chemistry changes at the treatment were examined with express technique based on the self-action of the picosecond range laser pulses at 1064 nm to uncover a possible surface response for the F-grafting. The technique has been successfully applied for the oxidized carbon surface diagnostics. The proposed approach can be the base of a future control on the production of the nanostructured carbon surfaces.