EFFECTS OF WET OXIDATION ON FLAME-FORMED CARBON NANOMETERIALS

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Abstract

Over the last decades, interest in carbon nanomaterials (CNs) in various research and application fields has grown exponentially. Among these nanomaterials, flame-made CNs – commonly referred to as soot - appear promising for the development of high quality materials and composites through chemical modification.

CNs, produced by carbon-based fuels, consists of aggregates of elemental and organic carbon. It can be converted into activated carbon (AC) by oxidation in solutions using acidic, basic or oxidant media. Chemical modification allows change in structure and reactivity of CNs by attaching oxygen-containing functional groups. The amount and the characteristics of these groups are influenced by different parameters including time of reaction and functionalizing agent. In this study, CNs are produced by premixed flame of ethylene/air in a McKenna burner at fixed equivalent ratio (Φ=2.46) and collected on a steel plate fixed at 15 mm above the burner surface. Successively, CNs are treated with different solutions in refluxing for 15 min, 30 min, 1 hr, 2 hrs, 3 hrs, 6 hrs to evaluate advancement of reaction. Qualitative and quantitative analysis are conducted by Fourier Transform Infrared Spectroscopy (FTIR) and elemental analysis (CHN). Strong oxidants (i.e. nitric acid) rapidly and mainly modify CN surface introducing oxygen-containing functional groups, such as carbonyl, carboxylic and alcoholic. Introduction of low percentage of oxygen are observed also in mild condition and limited time of reactions.

Further studies are needed to completely understand the chemistry of CNs in oxidative processes aiming to tune modification of chemical and physical properties of ACs to obtain high performance materials.