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Modification of the acid/base surface adsorption properties of granular carbon black by means of RF glow dischargesNicoletta De Vietro¹, Francesco Fracassi¹, Riccardo d'Agostino¹¹Dep. of Chemistry University of Bari, Bari, Italy

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Carbon black and other related carbonaceous materials are, nowadays, widely utilized as adsorbents for liquid and gaseous substances, as well as for other uses (e.g. reinforcing fillers in polymeric matrix, support for catalysts, etc.). Both surface chemical composition and morphology of the carbonaceous substrate play a crucial role in adsorption, adhesion and other properties relevant to the above applications. The chemical functionalities on the carbon surface, in particular, are traditionally split in two families, according to their acid or basic character in water.

To improve the adsorption ability towards acid and basic compounds in vapour/gas phase, carbon black granules were treated in low pressure 13,56 MHz RF glow discharges, generated in a suitable special rotating reactor which allows homogeneous processing of powders and granules. In order to graft acid or basic chemical groups and vary, consequently, the surface acid or basic character of the substrate, the plasma was fed with different gas mixtures: acrylic acid/argon and allylamine/argon, at different input power.

The effect of the plasma treatments on the carbon surface was evaluated by means of X-ray photoelectron spectroscopy and water contact angle measurements, performed immediately after the plasma process, after ageing in air and after heating. Scanning electron microscopy observations were acquired to evaluate the morphological changes induced by the plasma treatments on the surface of the carbon black granules.

Finally, to evaluate the ability of the processed carbonaceous material to adsorb basic and acid compounds in gas phase, vapour adsorption tests with ammonia, hydrochloric, acetic and propanoic acids were performed, respectively.

The results show that the plasma treatments significantly improve the adsorption ability of carbon black granules and this effect is mainly due to the surface grafting of acid/basic groups, and not to a morphological modification of the treated surfaces.

Keywords

carbon black

PE-CVD

Acrylic Acid

Allylamine

acid/base surface adsorption properties