On the relation between texture parameters and double layer capacitance of activated carbons

Radostin Nickolov,[1] Daniela Kovacheva[2], Mladen Mladenov[3], Neli Velichkova[2], Raicho Raichef[3], Penka Cvetkova[2]

[1] University of Chemical Technology and Metallurgy, 1756 Sofia, Bulgaria. *E-mail:* r_nickolov@uctm.edu
[2] Institute of General and Inorganic Chemistry, Bulgarian Academy of Sciences, 1113 Sofia, Bulgaria
[3] Institute of Electrochemistry and Electrochemical Systems, Bulgarian Academy of Sciences, 1113 Sofia, Bulgaria

The porous textures of activated carbons and their electrochemical double layer capacitance (DLC) in organic electrolyte prepared on the basis of spent coffee waste ground were investigated by using low-temperature nitrogen adsorption and constant electric current cycling methods. It was found out that the double layer capacitance of activated carbons did not have a linear relationship with their BET specific surface area.

A modified version of H. Shi's model [1] is proposed. Thereupon it is presumed that the DLC per unit of internal surface area (C_{INT}) is different from that per unit external surface (C_{EXT}) instead of using one fixed DLC for all sample porous surface

On the basis of the experimental data, the modified model is examined. A linear relationship: $\frac{C}{A_{EXT}}$ vs $\frac{A_{INT}}{A_{EXT}}$ (where C, A_{EXT} and A_{INT} are respectively the sample capacitance, external and internal surface areas) is observed on the basis of which relation C_{INT} and C_{EXT} of samples are calculated.

Thus calculated values of C_{INT} and C_{EXT} of carbon samples are considerable higher in comparison to the values of their capacitance per unit of BET specific surface area (i. d. specific capacitance C_0).

This fact gives evidence about the resultant character of C_0 as a ratio between respectively the sum of different capacitance per unit of constitutive parts of BET specific surface area (not of unity fixed DLC for all the porous surface of activated carbon) and the integral surface parameter, A_{BET}.

An assumption has been made that it is possible or not a linear relationship between double layer capacitance of activated carbons and their BET specific surface areas from arise in the dependence of the capacitances per unit of constitutive parts of BET specific surface area contributions.

References

1.   H. Shi, *Electrochem. Acta* 41 (1996) 1633