DETERMINATION OF THE VALUE OF C_{60} to C_{70} RATION BY THE METHOD OF ABSORPTION SPECTROSCOPY

Anikina N.S., Schur D.V., Zaginaichenko S.Yu., Zolotarenko A.D.
Mil'to K.A., Krivuschenko O.Ya.,
Institute for Problems of Materials Science of NAS of Ukraine,
3 Krzhizhanovsky str, Kiev, 03142 Ukraine
Fax./Тел.: +38 (044) 424-0381, E-mail:shurzag@materials.kiev.ua

Derivatives of C_{60} and C_{70} fullerenes attract researchers' attention because they give a possibility to produce new substances in the fields of chemistry, medicine, biology, to produce new materials for nanotechnology. Complex C_{60} compositions are widely investigated as optically active substances. Chemistry of metal complexes of fullerenes is progressing in many other directions of materials science. In this connection the development of highly effective technologies for production of C_{60} and C_{70} fullerenes is still very topical also as an analytical provision at all the stages of fullerenes production, extraction, separation and purification.

Information about the qualitative C_{60} to C_{70} ratio in the fullerene-containing soot produced by arc discharge or by pyrolysis, in extraction solutions used in separation of mixtures of fullerenes into individual fullerenes is of high applied and fundamental importance. The procedure for the express determination of the qualitative C_{60} to C_{70} ratio has been elaborated on the base of UV-VIS spectrometry. In this procedure the value of A_1/A_2 ratio is the main determining parameter, where A_1 and A_2 are optical densities of the solution studied at λ=335 and 287 nm, respectively.

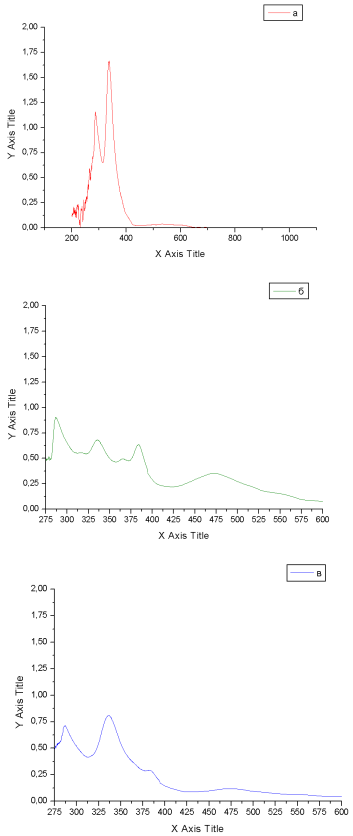

Fig.1. UV-VIS-spectrums: 1- C_{60}, 2- C_{70} and solution of fullerenes mixture.

In toluene solutions C_{60} and C_{70} the values of this ratio are determined by UV-VIS-spectrum (presented in Fig.1) and are equal to 1.43 and 0.754, respectively, and are independent on concentration. In solutions of C_{60} and C_{70} mixture the ratio become dependent on component concentration. By virtue of the fact that C_{60} and C_{70} solutions follow the Lomberta-Bera law, the ratio value was determined by equation

$$\frac{A_1}{A_2} = \frac{\alpha_1 x + \beta_1 y}{\alpha_2 x + \beta_2 y}$$

where α – is coefficient of extinction C_{60}, β– is coefficient of extinction C_{70}, X and Y are the respective mole concentrations of C_{60} and C_{70}. When X take the values 0.1; 0.2; 0.3….0.9 and Y – 0.9; 0.8; 0.7….0.1, respectively, we solve the equation and receive series of ratio A_1/A_2 values. Using the obtained values of ratio, the plot is constructed (Fig.2). Defining the ratio value by spectrum of investigated solution of fullerenes mixture, the percent ratio of C_{60} and C_{70} fullerenes is determined by plot of Fig.2.

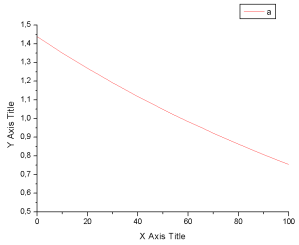

Fig.2. The graphical representation of dependence between percentage of C_{60} and C_{70} and value of C_{60}/C_{70} proportion.