

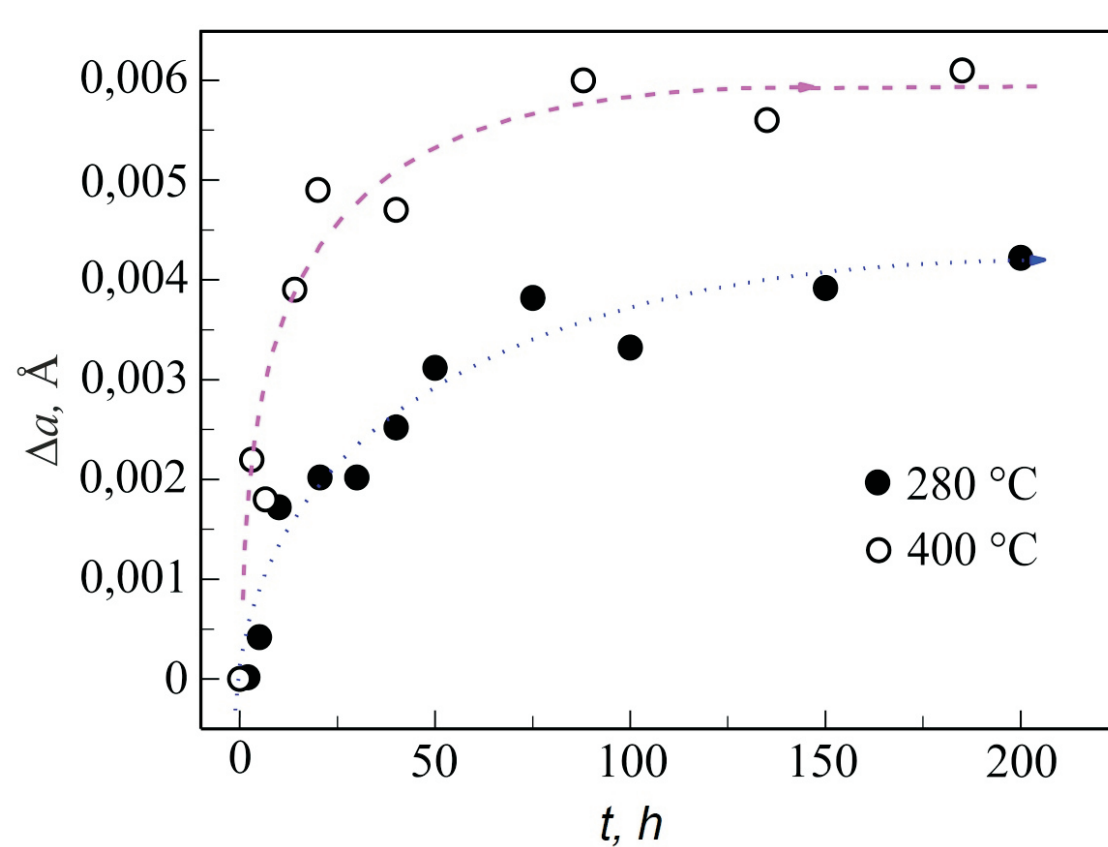
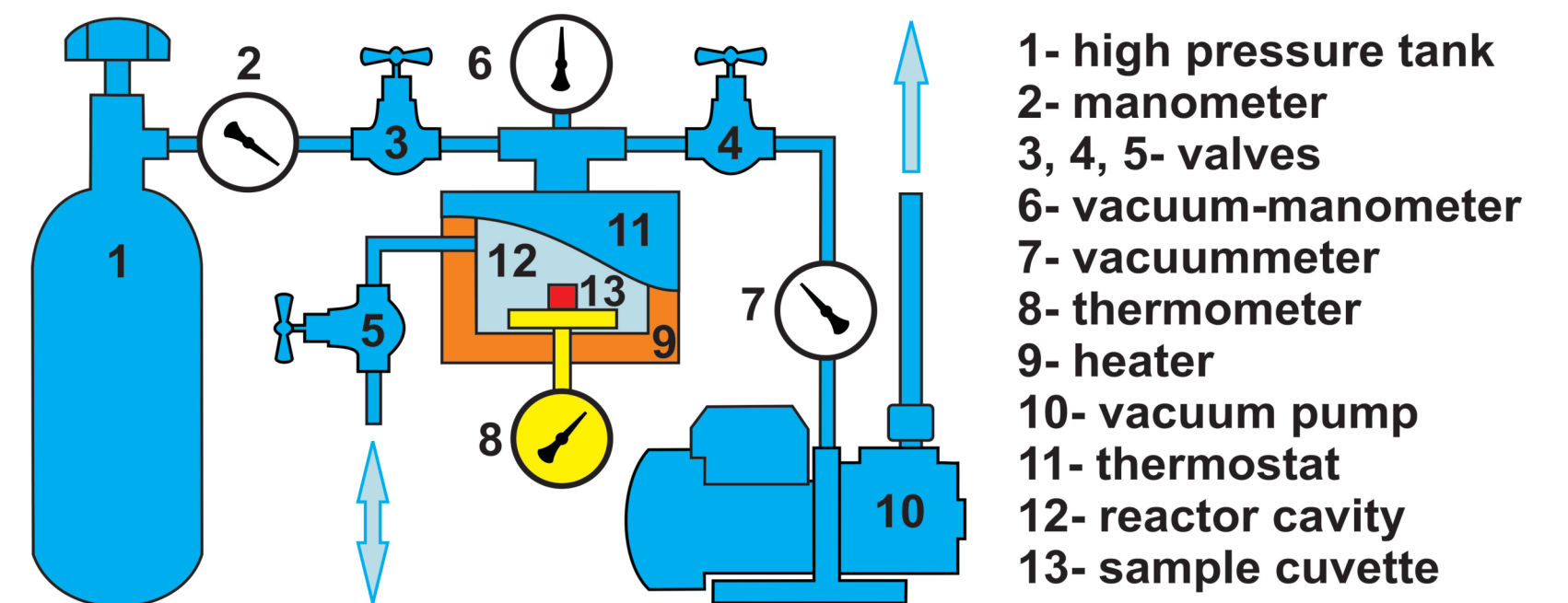
Effect of molecular impurity N_2 on photoluminescence and structure of fullerite C_{60} during diffusion intercalation and chemical sorption.

V. N. Zoryansky, P.V. Zinoviev, N.N. Galtsov and Yu.O. Semerenko.

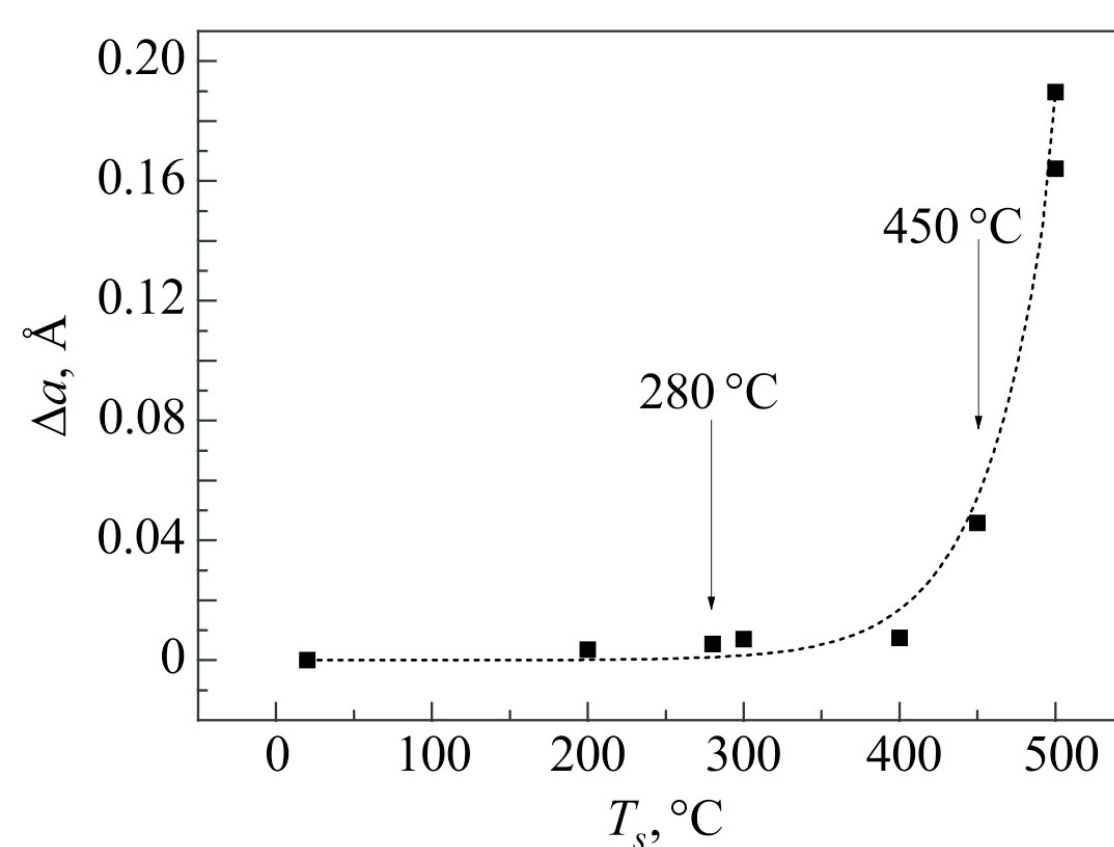
*B. Verkin Institute for Low Temperature Physics and Engineering of NAS of Ukraine,
47 Nauky Ave., Kharkiv, 61103, Ukraine*

zoryansky@gmail.com

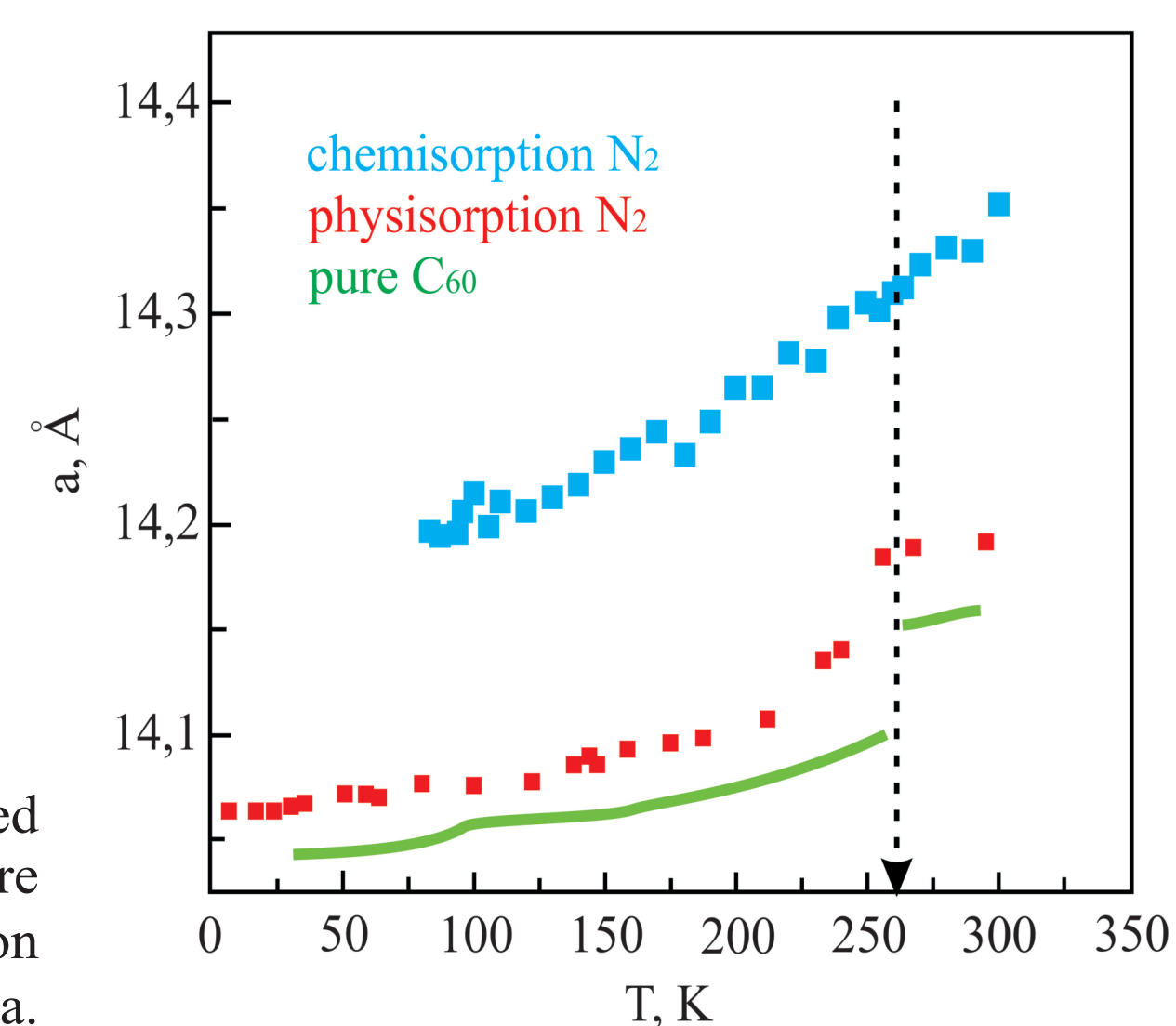
Polycrystals of C_{60} with an admixture of N_2 molecules were studied using X-ray diffractometry and photoluminescence spectroscopy in a wide temperature range (10-300 K). Saturation was carried out at various sorption temperatures (T_s) from 200 °C to 550 °C in a nitrogen atmosphere under a pressure of 30 atm. Consistent studies of the optical and structural characteristics of the $C_{60}+N_2$ complex, as well as their temperature behavior, were carried out. The kinetics of nitrogen sorption for different T_s and the efficiency of impurity diffusion were studied. The influence of the impurity on the orientational phase transition, the processes of glass state formation and the dynamics of electron excitation transfer were determined depending on the mechanism of interaction in the impurity-matrix system.



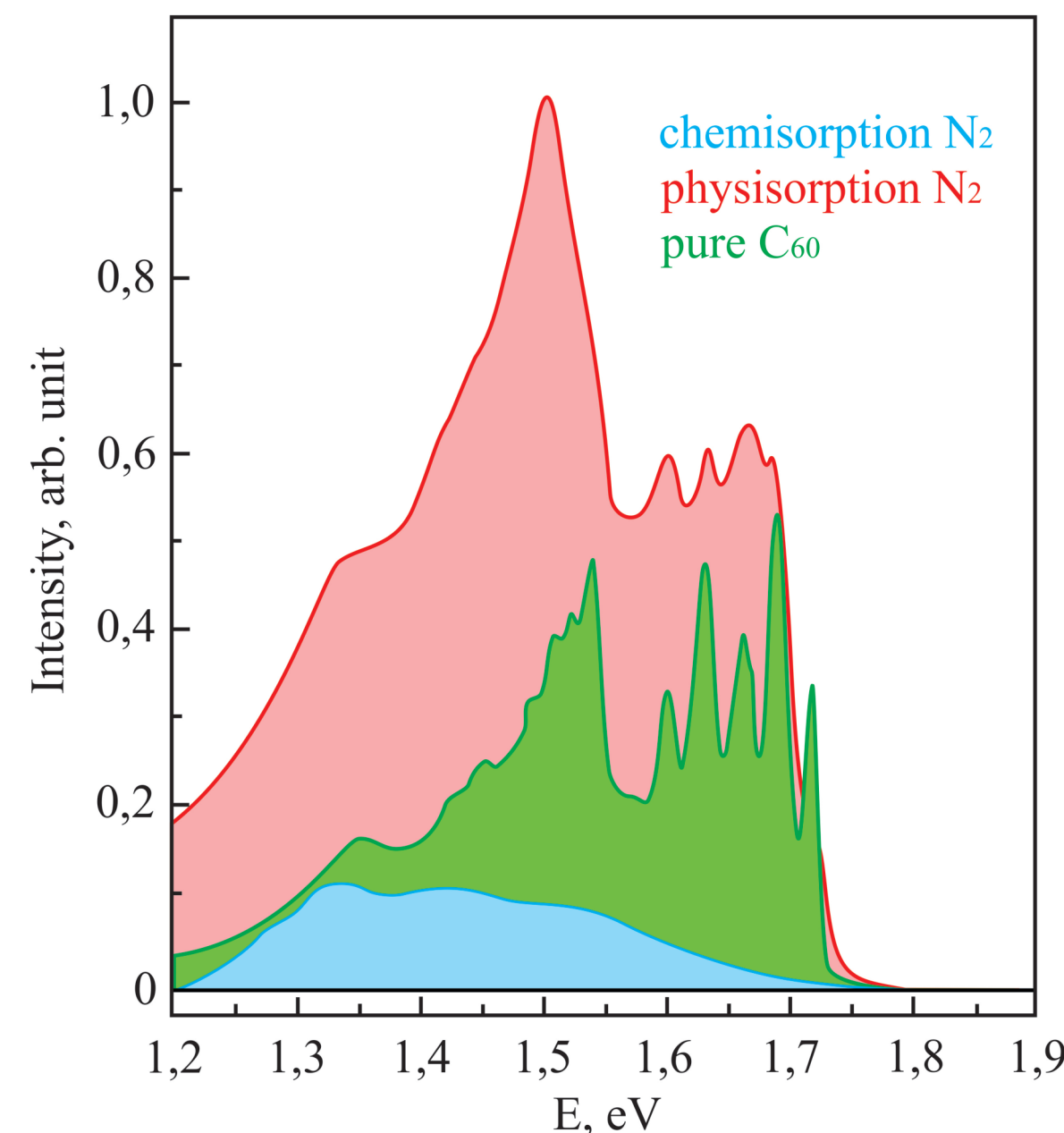
Change in the lattice parameter of fullerite C_{60} from the time (t) of filling octahedral voids with nitrogen molecules at a gas pressure of 30 atm and temperatures of 280 and 400 °C



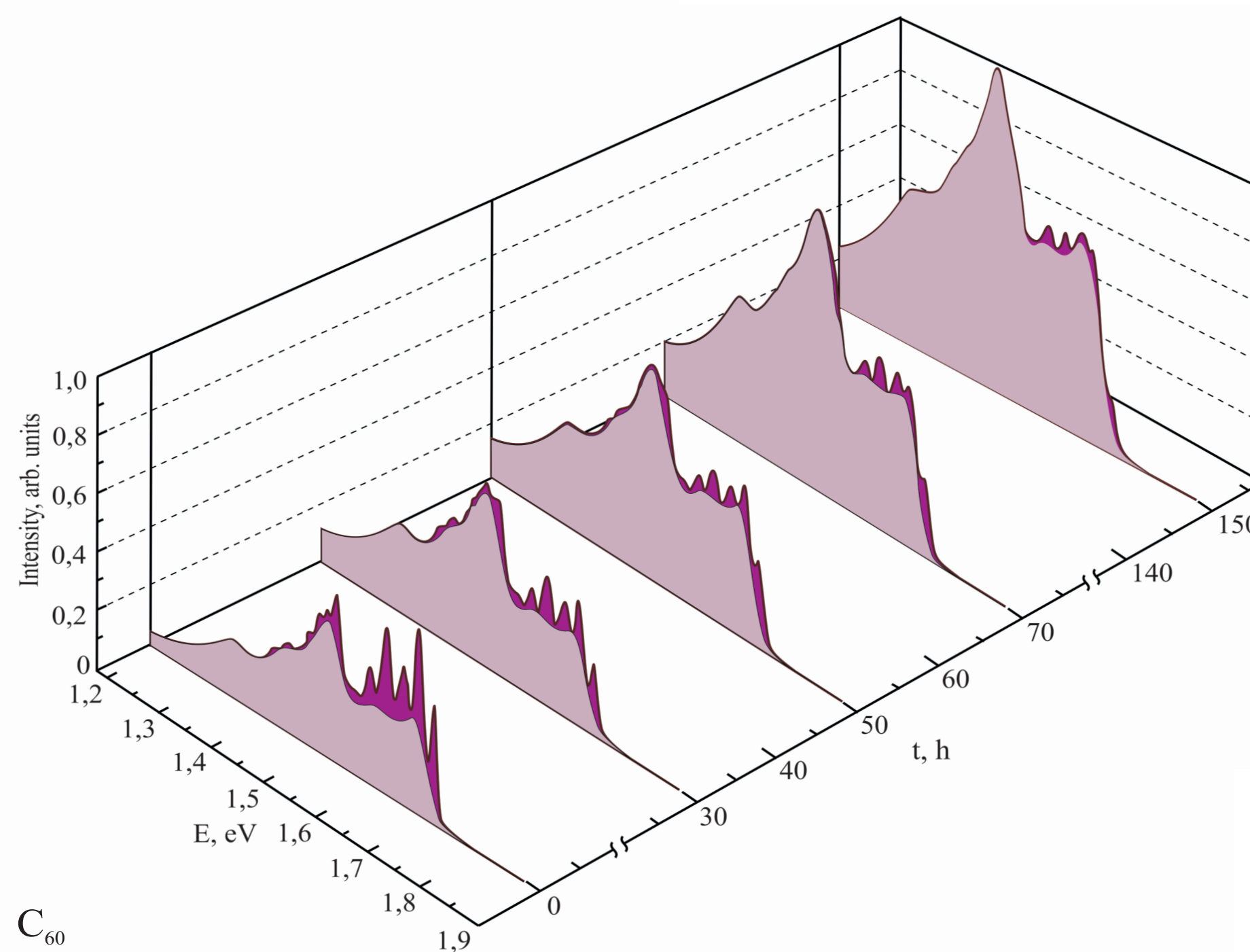
The change in the parameter a of the studied samples of C_{60} on the saturation temperature T_s with gaseous N_2 at a pressure of 30 atm on the base of experimentally obtained data.



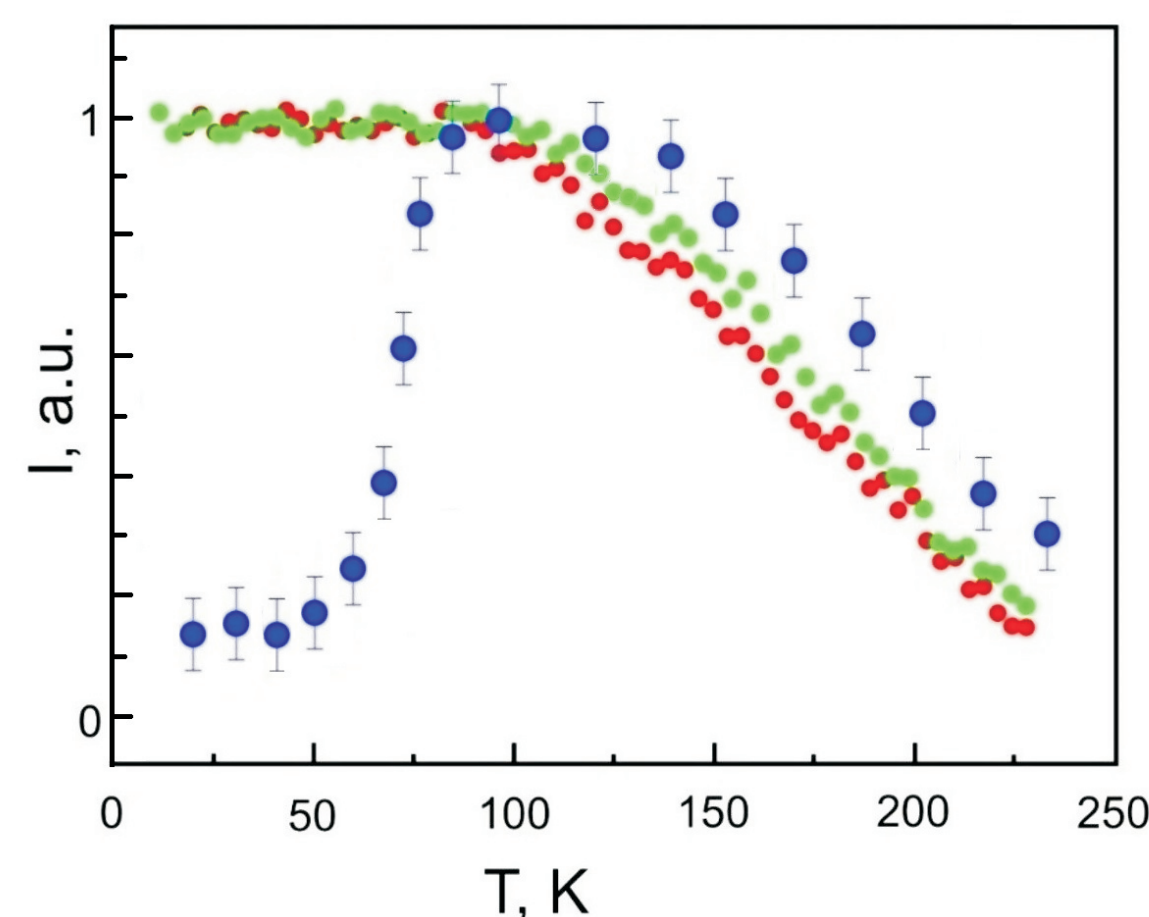
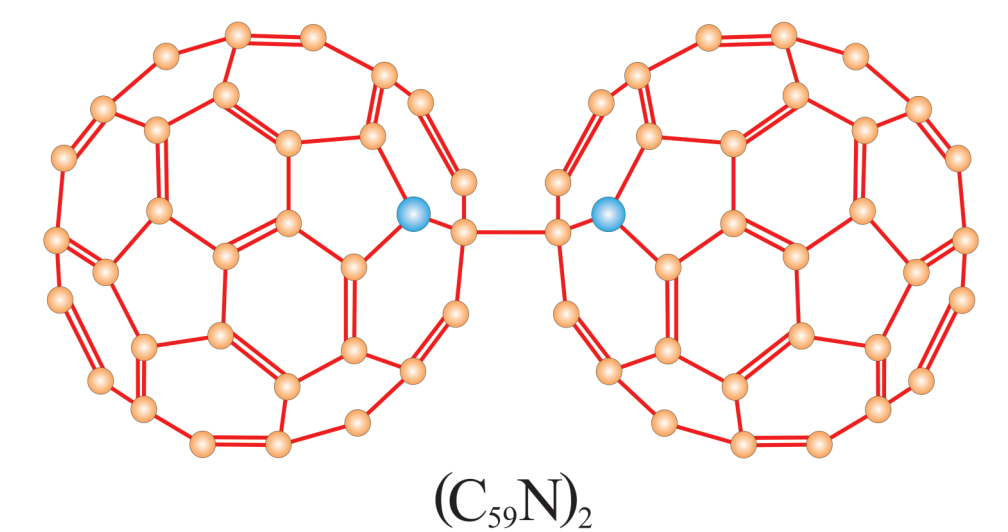
Temperature dependences of the lattice parameters of the chemical compound C_{60} with N_2 (blue), the solution of nitrogen insertion into fullerite C_{60} (red) and data for pure fullerite C_{60} (green).



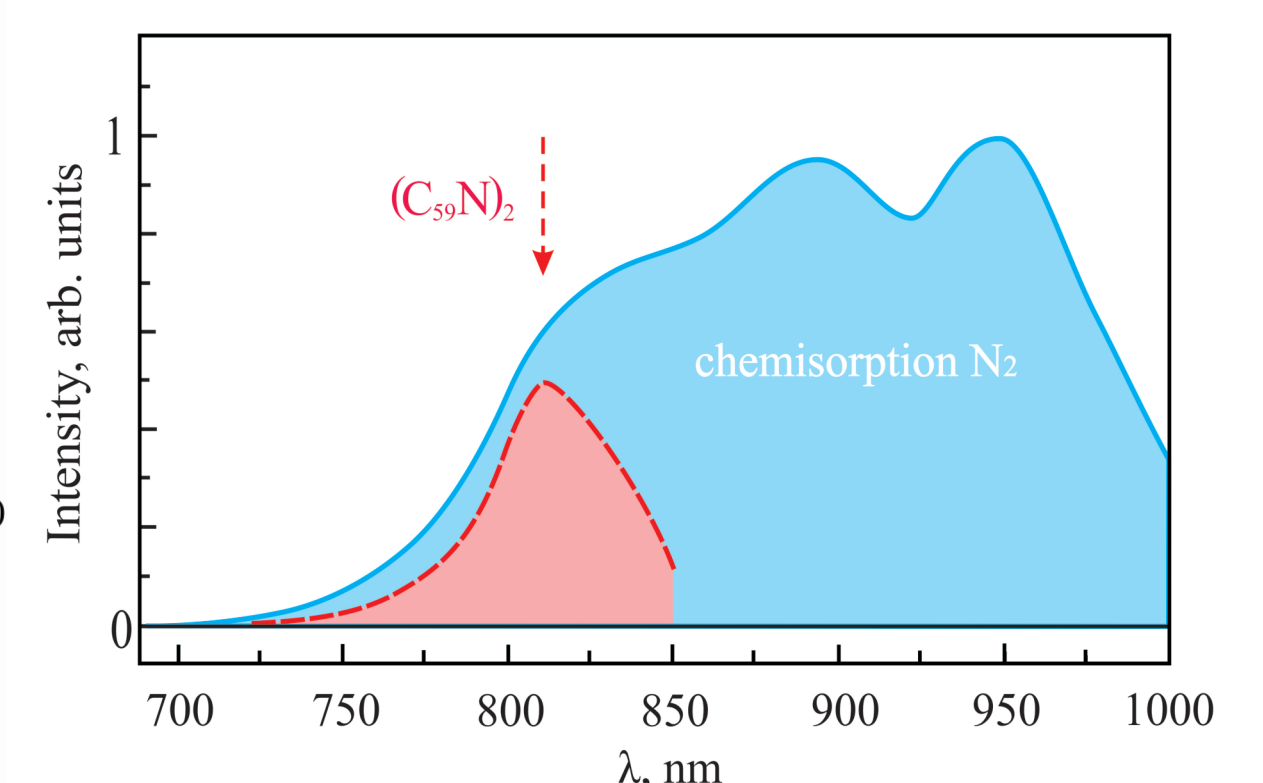
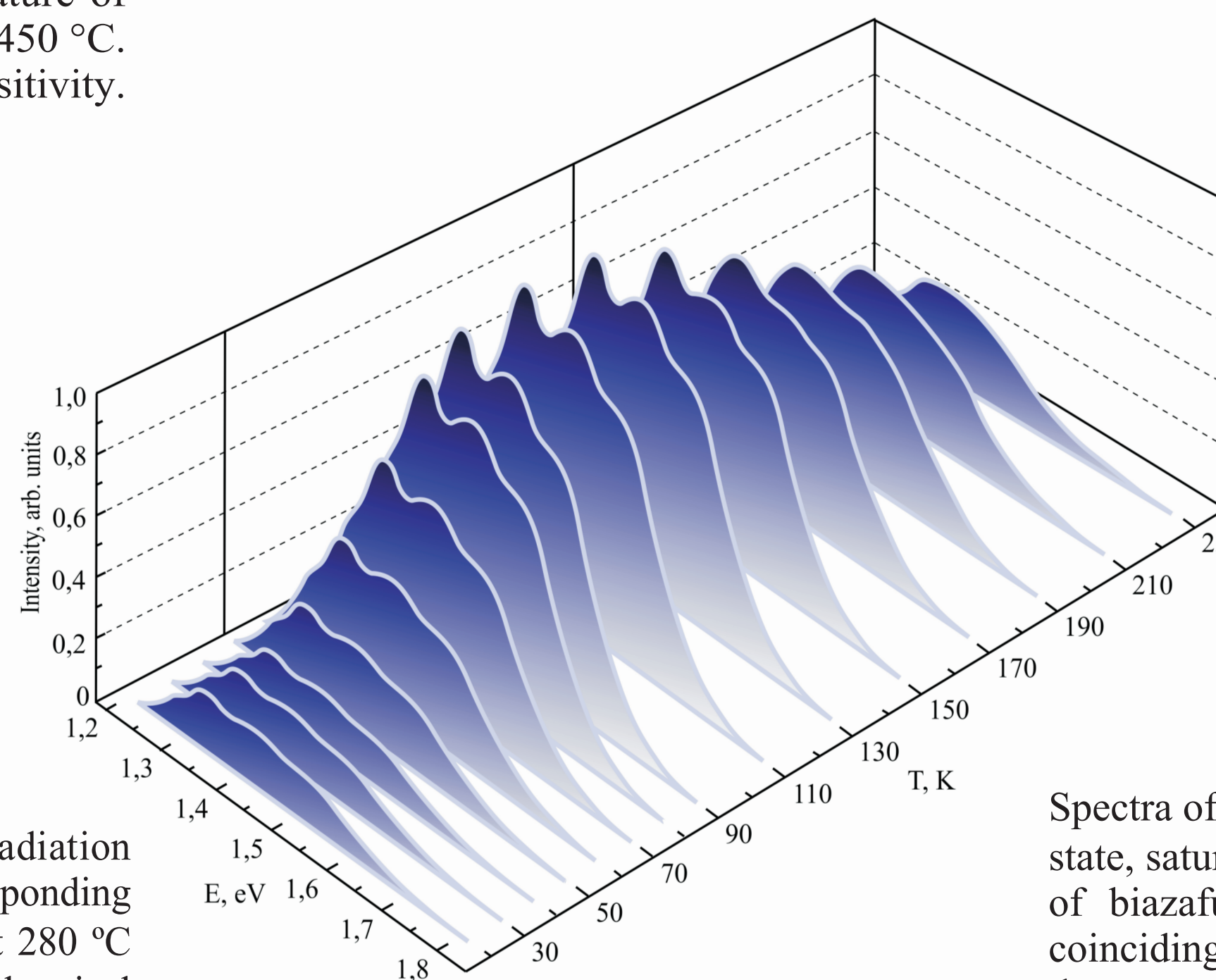
The photoluminescence spectra of a polycrystal C_{60} samples at 30 K: green - pure fullerite; red - C_{60} saturated with molecular nitrogen at a temperature of 280 °C and blue - saturated at a temperature of 450 °C. The spectra were corrected for the spectral sensitivity.



Dynamics of change in photoluminescent characteristics of fullerite C_{60} from the time of its saturation with nitrogen at $T = 280$ °C and $P = 30$ atm. Photoluminescence spectra upon excitation by light with an energy of 1.96 eV and at $T = 20$ K. Light parts indicate the contribution of luminescence from "deep X-traps" to each spectrum. The increase in intensity as saturation proceeds correlates with the degree of filling of intermolecular voids with impurity.



Temperature dependences of the integrated radiation intensities of C_{60} fullerite, normalized to the corresponding values at $T = 25$ K: pure - green, intercalated N_2 at 280 °C (physical sorption) - red, intercalated N_2 at 450 °C (chemical sorption) - blue. All curves are measured in heating mode.



Spectra of chemically modified fullerene C_{60} in the crystalline state, saturated in a nitrogen atmosphere (blue) and a solution of biazafulerene in toluene (red - data from [1]). The coinciding onsets of luminescence at 812 nm indicate the presence of azafulerene dimers in the studied samples.