RELEVANCE AND PROSPECTS FOR STUDYING LOW-TEMPERATURE PHOTOLUMINESCENCE OF GO OF VARIOUS MORPHOLOGIES AND ITS DERIVATIVES WITH IMPURITIES.

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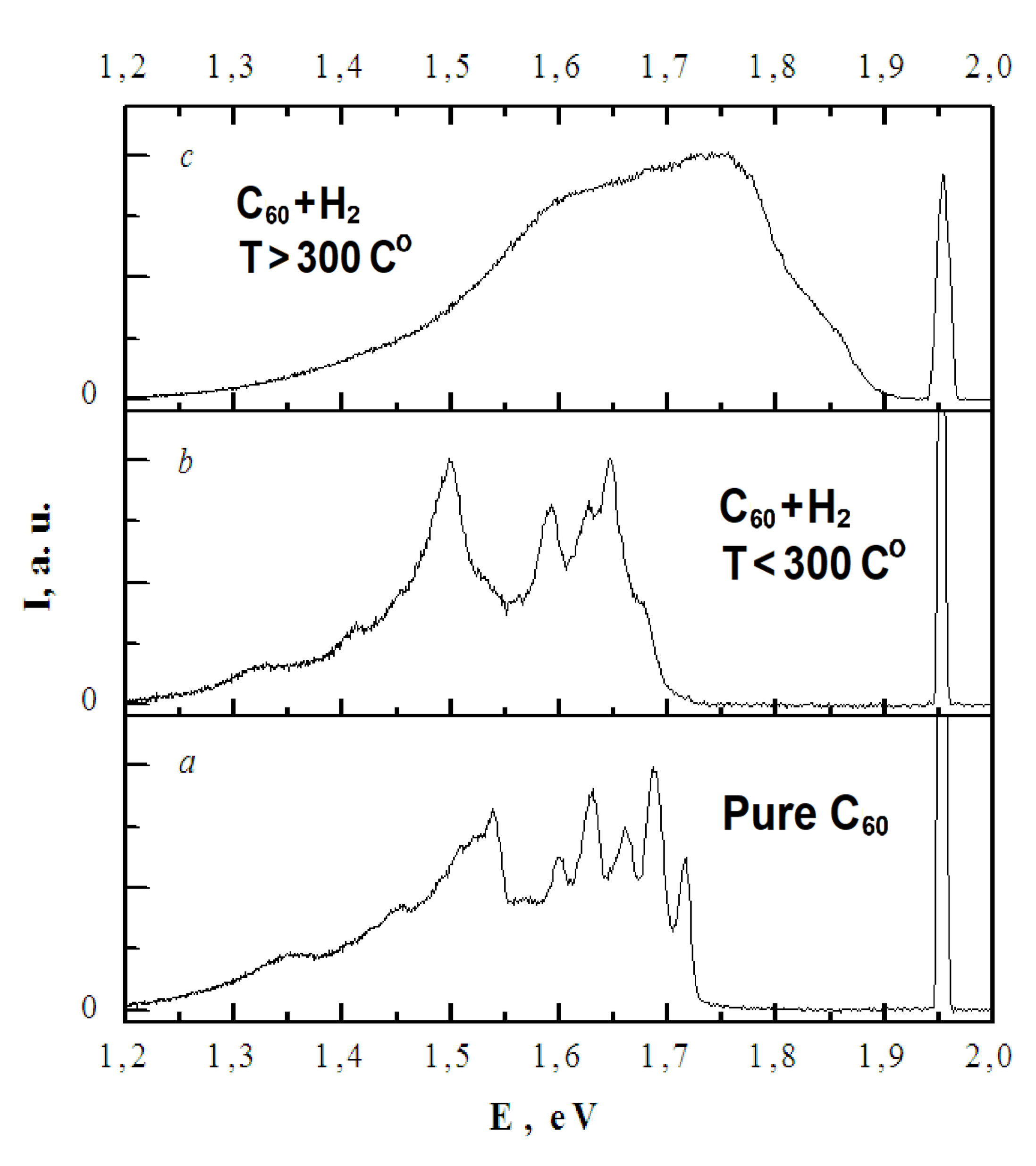
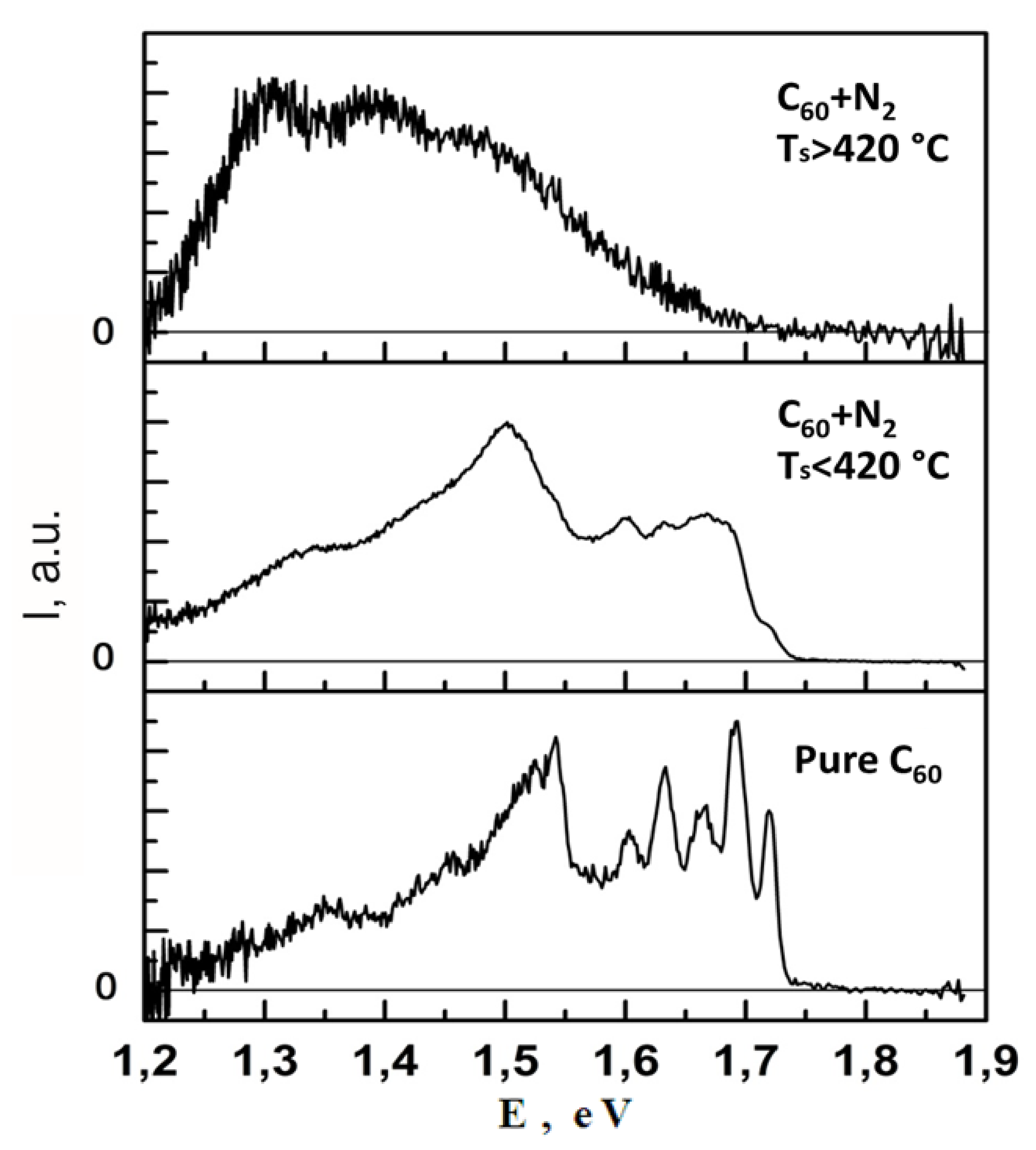
Recording the temperature dependences (20-300 K) of the integral radiation intensity in the mode of continuous quantum counting is a powerful tool for studying the dynamics of electronic excitations, their features and changes with temperature, in carbon structures regardless of the quantum yield of materials. Such experiments help clarify the presence and specificity of various phase transformations and record changes in the energy spectrum of a nanomaterial in the presence of impurities with different chemical activity. Thus, for the $C_{60}+H_2$ and $C_{60}+N_2$ systems, which have the limits of the adsorption crossover (transition from the diffusion mechanism of intercalation - physisorption, to the chemical interaction - chemisorption), respectively 300°C and 420°C [1,2], spectral-luminescence studies confirmed the formation of new chemical compounds - hydrofullerite $C_{60}H_x$ and biazafulerite $(C_{59}N)_2$. At the same time, it was the registration of the temperature dependence of the integral intensity of luminescence from low to room temperatures according to the indicated method that showed that for $C_{60}H_x$ there is no orientational phase transition and the transition to the glassy state, and for $(C_{59}N)_2$ quenching of photoluminescence at low temperatures was found [3].

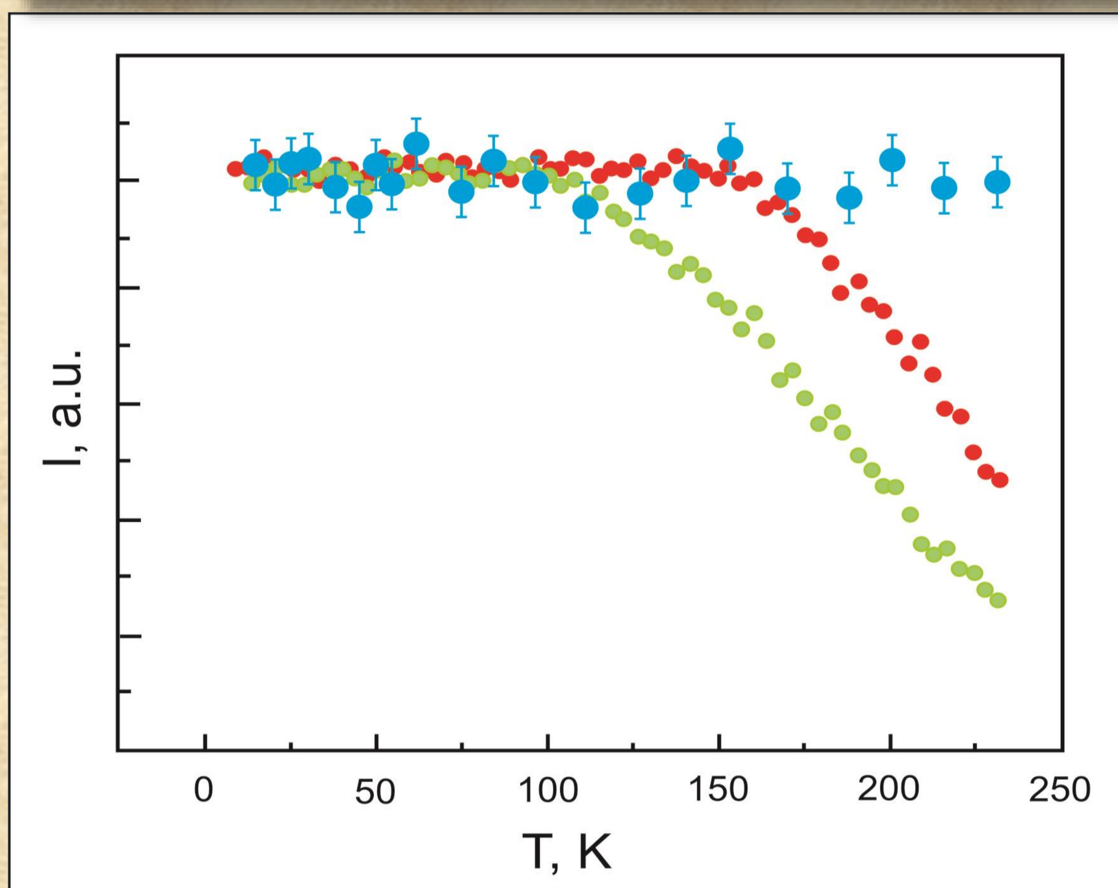
According to the literature, some carbon nanocompounds based on graphene oxide at room temperature also demonstrate a change in optical properties in the presence of impurities. For example, in [4] the quenching of photoluminescence of GO by metal ions in an aqueous medium was discovered, and in [5] determined the influence of carbohydrate saturation of graphene suspension (GS), which also leads to a decrease in the quantum yield of the substance. As a result, the similarity of the observed changes in the luminescent properties of various compounds of the graphene group with those of fullerite compounds has been established, which may indicate the similarity of both the emission mechanisms in such carbon nanostructures and the response of their energy spectrum to the presence of impurities. The conclusion from this is that the study of spectral-luminescent properties by the method of continuous recording of the integral luminescence intensity in the temperature range of 20-300 K may make it possible to identify new optical or structural properties for these compounds.



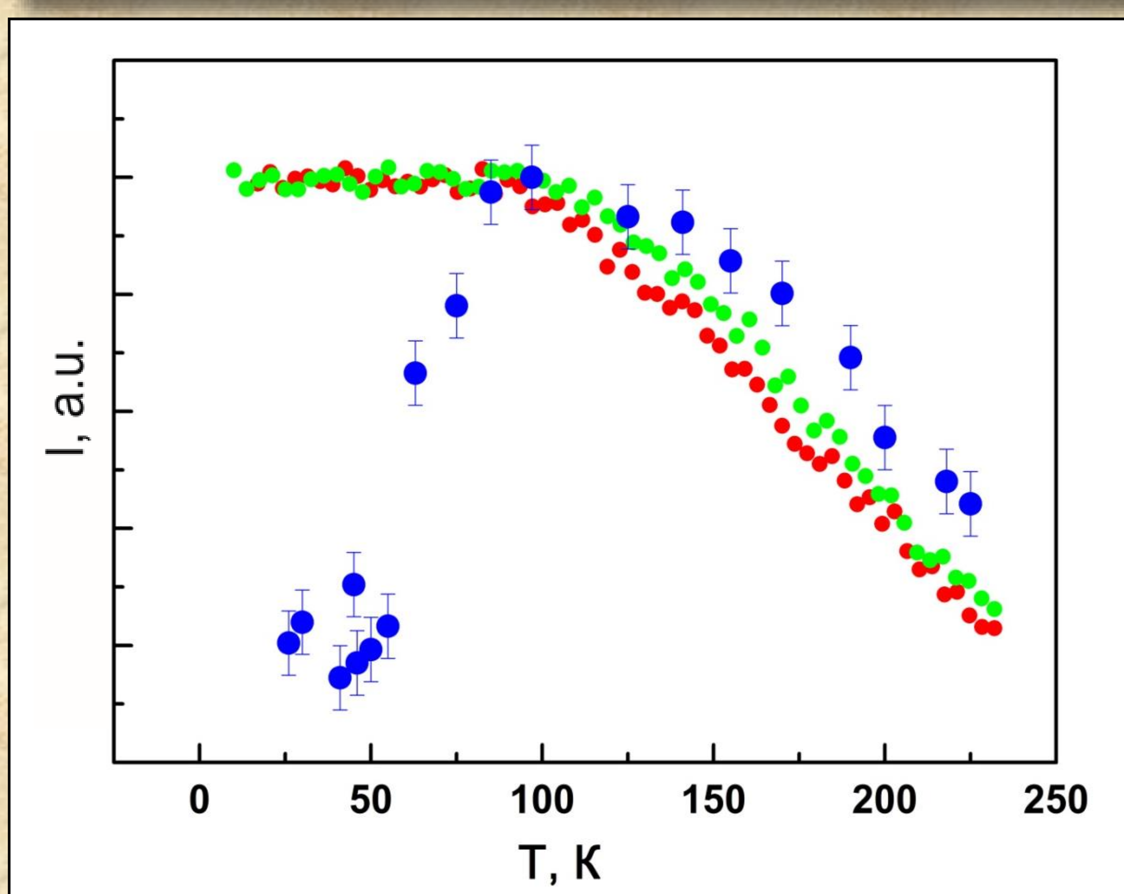
Dynamics of changes in the PL spectra of fullerene C_{60} the saturation temperature of the H_2 at P = 30 atm. T = 10 K



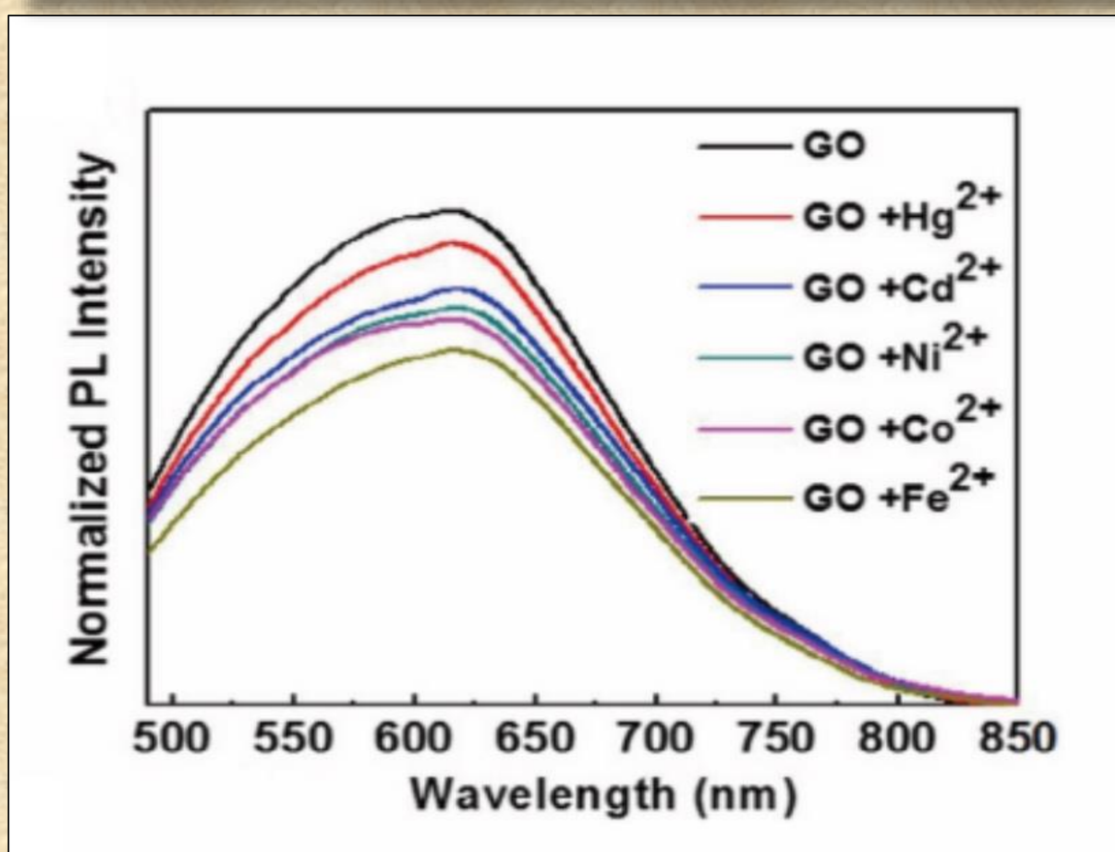
Dynamics of changes in the PL spectra of fullerene C_{60} the saturation temperature of the N_2 at P = 30 atm. T = 20 K



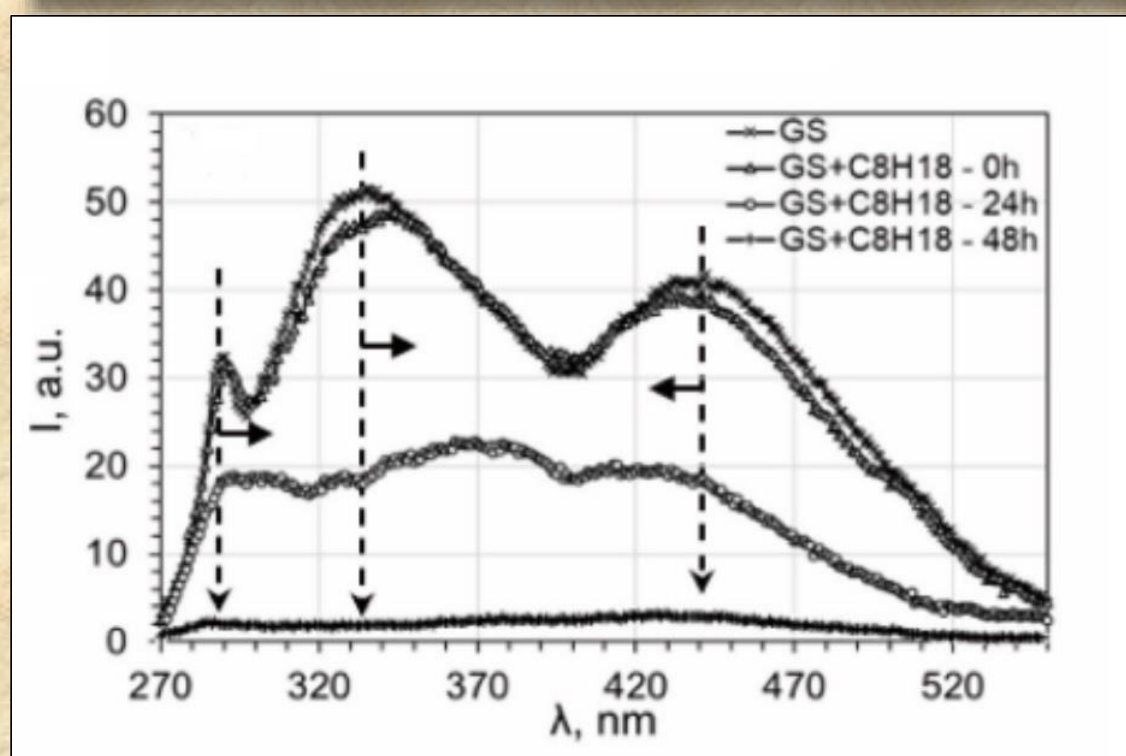
Normalized temperature dependences of the integrated radiation intensities of fullerite C_{60}
green - pure C_{60};
red - intercalated with H_2 at 200 ºC 30 atm., 175 hours (physical sorption);
blue - intercalated with H_2 at 300 ºC 30 atm., 1270 hours (chemical sorption).



Normalized temperature dependences of the integrated radiation intensities of fullerite C_{60}
green - pure C_{60};
red - intercalated with nitrogen at 280 ºC 30 atm., 150 hours (physical sorption);
blue - intercalated with nitrogen at 450 ºC 30 atm., 200 hours (chemical sorption).



PL spectra of GO solution with different metal ions.
D.-Y. Wang, et al. /Carbon, 82, 24, (2015).



The effect of saturated hydrocarbon on photoluminescence spectra of GS (excited by 270 nm).
Y.V. Pakharukov, et al. / Colloid Interface Sci. Commun., 42, 1, 100431, (2021).