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SPIN-SELECTIVE CHARGE RECOMBINATION IN HALOGEN-CONTAINING DERIVATIVES OF POLY–N–EPOXYPROPYL CARBAZOLE DOPED WITH POLYMETHINE DYE

N.Ibrayev (1), A.Yedrissov (1) D.Afanasyev (1,2)

(1) Buketov Karaganda State University, Karaganda, Kazakhstan
(2) Institute of Applied Mathematics, Karaganda, Kazakhstan

Polymer composite films based on semiconductor polymers and organic molecules attract the attention of researchers due to their using in electroluminescent and photovoltaic cells. Semiconductor polymers doped with organic molecules have properties that are not possessed by pure polymers. They are used as elements of organic electronics, and as a model system for the study of the formation and recombination of charge carriers in organic semiconductors. But a degree of influence of the heavy atom effect on magnetic spin processes in semiconductor polymers was been studied a little. Further research in this area is interested.

Properties of recombination luminescence of polymethine dye in matrices of derivatives of poly-N-epoxypropyl carbazole (PEPC) with heavy atoms of various chemical nature were investigated. The observed luminescence kinetics is formed by the fluorescence of the dye and recombination luminescence associated with the formation and recombination of electron-hole pairs (EHP). The presence of heavy atoms in the structure of the polymer increases the rate of singlet-triplet transitions in the dye molecule due to the growth of the spin-orbit interaction. Measuring the external magnetic field effect on the kinetics of dye luminescence in a wide time range allowed to determine the characteristic times of the recombination processes with the participation of EHP formed from singlet and triplet excited electronic states of the dye molecules. Rates of the formation and the recombination of singlet EHP are higher than the deactivation rate of the S1 state of dye molecules. A rate of the recombination of triplet EHP is significantly lower than the photo processes rate connected with deactivation of the S1 state of dye molecules and the singlet EHP recombination. A comparison of the dependence of the magnetic effect g on the magnetic field induction B shows the competing influence of the external magnetic field and the spin-orbit interaction (SOI) on the spin state of the EHP. The competing influence manifests itself in different ways in the curves of dependence of g on B for the EHP with the initial singlet and triplet states of the pair. For singlet EHP, the growth of SOI in films leads to an increase in g(B). For triplet EHP, the presence of SOI reduces the value of g(B). These results suggest about growth in singlet-triplet transitions rate, upon increased SOI in films.