Nanooptics and nanophotonics

Features of the delayed luminescence of polymethine dyes in polymer films under ultraviolet photoexcitation

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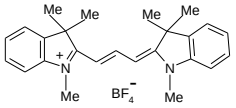
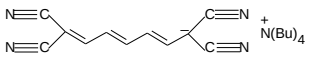
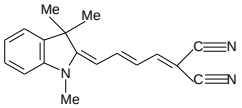
Features process of electronic energy transformation in polymer composites based on polyvinyl butyral (PVB) and poly-N-epoxypropylcarbazole (PEPC) doped with 1 wt.% cationic (PD1), anionic (PD2) and neutral (PD3) polymethine dyes (PD) were investigated under ultraviolet excitation. PEPC has photoconductivity and migration of electronic excitations in contrast with no photoconductive polymer PVB. It can lead to a difference between electronic energy transformations in different polymer matrices with PD's.



PD1



PD2



PD3

Excitation of delayed luminescence (DL) was performed by laser LCS-DTL-374QT (λ_{GENER} =355 nm, pulse energy E=5 μJ, pulse duration τ=10 ns and λ_{GENER} =532 nm, E=30 μJ, τ=7 ns). Lifetime of DL of dyes was increased under 355 nm excitation of samples compared with the lifetime of DL of dye under excitation by 532 nm. Lifetime of DL of dyes under excitation by λ_{GENER} =355 nm corresponds to the lifetime of the polymers. A positive time-dependent magnetic field effect is observed for films based on PEPC – PD. It can be associated with hetero annihilation of electron excitations of PEPC polymer and PD's. Competition between hetero annihilation and recombination luminescence was observed for films of PEPC-PC1 and PEPC-PC3. Positive magnetic effect is absent for films with PVB. This shows that the hetero annihilation process is absent in PVB-based films. This may be due to the lack of triplet energy migration to the polymer.