NONLINEAR OPTICAL CHROMOPHORES WITH ORIGINAL ACCEPTOR AND DONOR BLOCKS

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The nonlinear optical properties of the donor-acceptor chromophores in polymer matrix attract the great interest being connected with the material searching for radiophotonics application. That material has to poses the high thermal stability apart from the second order optical nonlinearity itself. There are two reasons why the material has to poses the high thermal stability: the first for one is the burning of the spin-coated chromophore-polymer films to remove the high-boiling organic solvent at the temperature higher 100 ^{0}C; the second one is the poling of the chromophore-polymer films at the action of the electrical field at the temperature higher the glass-transition temperature of the polymer matrix.

The chromophore-polymer films containing the synthesized donor-acceptor chromophores in polymer matrix (the examples of the used structures I, II, III are shown on fig 1) were obtained and investigated by the thermal analysis methods. The determination of the nonlinear optical properties of guest-host chromophore-polymer films were carried out also.

The composite material of new synthesized 4-((4-(N,N-n-dibutylamino) phenyl)diazenyl)-biphenyl-2,3,4-tricarbonitrile (GAS dye – structure I) in commercial poly(styrene-co-methyl methacrylate) (PSMMA, structure III) was prepared, poled and its nonlinear optical properties compared with DR1 dye were studied. The dipole moment, polarizability tensor, and first hyperpolarizability tensor of the investigated dyes were calculated by within the framework of the coupled perturbed density functional theory.

A nanosecond second-harmonic generation Maker fringes technique (see Set-up for Second Harmonic Generation measurements on fig 1.) was used which is capable of providing the magnitude of the second-order nonlinearity of optical materials at a wavelength of 1064 nm. For the tested GAS–PSMMA composite material, maximal coefficient d_{33} was found to be 50 pm/V.

The polymer-chromophore samples with tricyanopyrroline (TCP) chromophore (structure III) were prepared by spin-coating method in polycarbonate and PSMMA matrix on the ITO covered glass. The electro-optical properties of the films were studied by Teng-Man technique.

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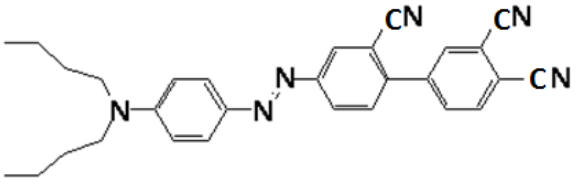
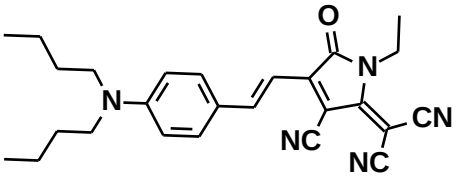
Fig. 1 The structures of the chromophores I, II and polymer unit III and Set-up for Second Harmonic Generation measurements - IV



I



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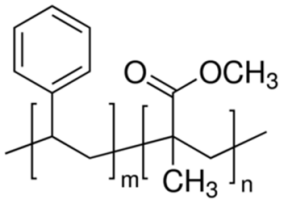
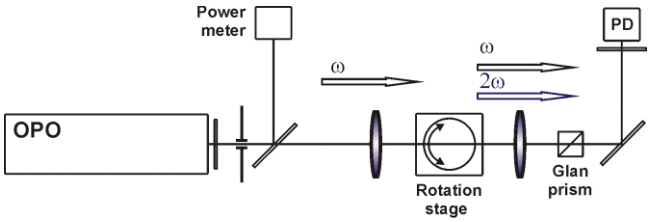


III



IV