NOVEL POLYMERS AND POLYMER BLENDS FOR OPTOELECTRONICS

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We focus on synthesis, electrochemical, optical, electric, and photophysical study of novel polymers and polymer systems for optoelectronics, such as for LEDs, photovoltaic or electrochromic devices. Novel π-conjugated polymers, soluble poly(*p*-phenylene)-based polymers, poly(fluorene-2,7-diyl)s and copolymers, fluorene-thiophene copolymers, thiophene-based oligomers and polymers, and σ-conjugated modified polysilanes with attached π-conjugated groupings moieties were synthesized and studied. The absorption and emission of the polymers under study cover the whole visible spectral region. Novel polymers with the donor as well with acceptor nature were prepared; the estimated ionization potentials (HOMO) were in the range 4.8 - 5.8 eV and electron affinities (LUMO) 2.8 - 3.8 eV.

Photoluminescence (PL), electroluminescence (EL) and charge photogeneration in the polymers are studied by several techniques. Methods of photoinduced surface potential decay (xerographic), DC and pulse photoconductivity are used for the charge photogeneration and dissociation. Information about charge mobilities and charge trapping are obtained from the time of flight measurements and their analysis. Complementary information about charge transport and deep trapping can be obtained from the dark discharge characteristics using xerographic method. The data are analyzed in the frame of several charge photogeneration and transport models; for example separation distances of generated electron-hole pairs can be obtained by experimental data modeling. Enhancement of EL or charge photogeneration efficiency in polymer blends of appropriate composition was demonstrated. The results were in good agreement with the PL study. Both steady-state and time-resolved PL techniques are used for characterization of polymer solutions and thin films.

Recently, very interesting polymers for photovoltaics, low-band-gap oligothiophenes and copolymers based on fluorene and 4,6-di(2-thienyl)thieno[3,4-*c*][2,1,3]thiadiazole units with a long-wavelength absorption up to 950 nm were synthesized and studied.

Thin film and device preparation and also optical, electrochemical, photoelectric and electric measurements are performed in an inert atmosphere (glove box system). The results of the measurements can be compared with those obtained in vacuum or under ambient conditions.

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