PHOTOEFFECT IN POLYTHIOPENTACENE FILMS AND INFLUENCE OF PERMANENT ILLUMINATION ON IT

M.P. Gorishnyi

Institute of Physics, Nat. Acad. Sci. of Ukraine
(*46, Nauky Prosp., Kyiv 03680, Ukraine;*
e-mail: gorishny@iop.kiev.ua)

S u m m a r y

The internal photoeffect in polythiopentacene (PTP) films is investigated. It is discovered that, in capacitor cells, the spectral dependence of the frontal photo-emf $V_{\rm f}$ correlates with the PTP absorption spectrum, while that of the back photo-emf $V_{\rm b}$ anticorrelates with it. The polarities of $V_{\rm f}$ and $V_{\rm b}$ coincide. In this case, the charge of the free PTP surface is negative, whereas that of the frontal SnO_2-electrode is positive. $V_{\rm f} = V_{\rm Df} - V_{\rm df}$ and $V_{\rm b} = V_{\rm db} - V_{\rm Db}$, where V_{Df} and $V_{\rm Db}$ are diffusion components, $V_{\rm df}$ $V_{\rm db}$ are drift frontal and back components, respectively. The quantities $V_{\rm df}$ and $V_{\rm db}$ are caused by the antiblocking bending of the bands for holes near the free PTP surface and the back SnO_2-electrode, respectively. The strong-absorption monochromatic frontal illuminations with the energies of quanta of 1.73 and 2.67 eV increase the absolute value of $V_{\rm df}$, which decreases the resulting $V_{\rm f}$ in the spectral range 1.4–2.2 eV and changes its polarity in the range 1.4–1.6 eV. The low-absorption frontal illuminations with the energy of quanta of 1.54 and 2.15 eV decrease $V_{\rm df}$ in the spectral range 1.6–2.0 eV and increase it in the range 1.4–1.6 eV. If the intensity of these illuminations $I_{\rm pi} \geq 2$ W/m^2, $V_{\rm f} \approx V_{\rm Df}$ in the range 1.6–2.0 eV and determines the magnitude of the true diffusion photo-emf. Back low- and strong-absorption illuminations photogenerate holes that diffuse to the free PTP surface and decrease $V_{\rm df}$. These illuminations change the polarity of $V_{\rm b}$. The spectra of the density of short-circuit current $J_{\rm sc}$ of the sandwich cells SnO_2PTPAg and $V_{\rm b}$ correlate. Under the modulated illumination of these cells through the SnO_2 and Ag-electrodes, the drift flow of nonequilibrium holes in the electric field, conditioned by the antiblocking bending of the PTP bands near these electrodes, prevails.