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Photoconductivity analysis of photovoltaic structures based on TiO_2 and poly(3-hexylthiophene)

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Abstract – This work uses measurements of photoconductivity to study charge transport in an ITO(indium tin oxide)./ TiO_2(titanium dioxide)/ P3HT(poly(3-hexylthiophene))/Al structure, which is used as organic photovoltaic device. Spectral photoconductivity measurements were carried out and symbatic and antibatic were adjusted by a model that takes into account the generation of carriers and recombination processes.

Junction devices utilizing semi-conducting polymers as active material have been considered to be a candidate for highly efficient low cost solar cells. In this work we have measured the photocurrent action spectra of sandwich cells with structure: ITO(indium tin oxide)./ TiO_2(titanium dioxide)/ P3HT(poly(3-hexylthiophene))/Al. The TiO_2 and P3HT films were obtained by spin-coating technique. The oxide was deposited on ITO from a colloidal dispersion of nanoparticles and this partial structure was thermally treated at 450℃ fo r 30 minutes. Subsequently, a P3HT film from chloroform solution was deposited on the inorganic layer. Finally, Al was evaporated on the polymeric layer. Photocurrent action spectra were measured with different applied bias and at several temperatures. Measurements were carried out either the illumination being through the ITO or through the aluminum electrode, in both cases with positive and negative bias. With a theoretical model that takes into account the generation-recombination processes, important parameters of the devices were obtained