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# Multi Role of Novel Ru Based Dye in Enhancing the Performance of Hybrid $TiO_2$/P3HT Solar Cells

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Hybrid polymer solar cells using colloidal Titanium dioxide ($TiO_2$) nanoparticles as acceptors and poly(3-hexylthiophenee) (P3HT) as donor material represent one of the most promising routes towards low-cost, renewable, carbon-neutral production of electrical power. However the poor power conversion efficiency found in such devices is mainly attributed to the poor compatibility between the metal oxide and polymer. This causes a higher degree of inefficient exciton dissociation at the heterojunction and interfacial charge recombination. Interface modification is a well-known and powerful technique to address this issue and the field has made impressive progress in recent years[1-4].

In this work, a thin layer of commercially available and widely used ruthenium (Ru) based dye, N719, and a newly synthesized $[Ru(bpy)_2(dcbpy)][PF_6]_2$ (bpy = 2,2'-bipyridine; dcbpy = 4,4'-dicarboxy-2,2'-bipyridine) dye (RuC2) were introduced separately at the $TiO_2$ / P3HT interface, and their effect in photovoltaic parameters were examined. UV-VIS spectroscopic measurement of the dye coated $TiO_2$/P3HT nanocomposite and its control show that dye has a very weak contribution of the optical absorption of the nanocomposite. The results indicate that these two dyes only facilitate the electron transfer from P3HT to $TiO_2$ than contributing charge carriers for device current. In addition, the RuC2 treated devices showed about a factor two enhancement in the power conversion efficiency compared to the devices treated with N719 dye. The reason for this observation may be due to the better adsorption of RuC2 dye on the surface of $TiO_2$ than N719 dye as the dyes used in this study mainly differ in their chemical structures; the N719 dye consist NCS functional group along with substituted two biphenyl rings, whereas the newly synthesized dye contains three biphenyl rings with two COOH groups.

**Keywords:** hybrid solar cell; P3HT; metal oxide; Ru dye

**References**

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