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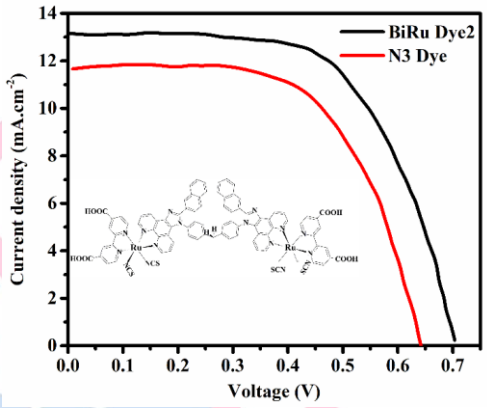
π- Extended Dinuclear Ruthenium(II) Complex for Dye-Sensitized Solar Cell

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Dye-sensitized solar cells (DSSCs) have been evaluated for photovoltaic applications because of their low cost and high-power conversion efficiency [1]. Polypyridyl ruthenium complexes with ligands functionalized by thiophene, carbazole, and and π-extended moiety can be regarded as super sensitizers [1]. Herein, a new π-extended binuclear ruthenium (II) complex (BiRu2) with two naphthyl moiety was designed and synthesized and used as dye in DSSC. CV results showed that the $E_{1/2}$ oxidation of BiRu2 dye is shifted negatively by 0.02 V compared to the N3 couple, as standard dye, [2] indicating stronger electron-donating ability of the fused π-expanded ligand than H_2dcbpy. The calculated excited state oxidation potential (E^* = -0.97 V) for BiRu dye is close to N3 dye and sufficiently more negative than the conduction band (CB) edge level of the TiO_2 at approximately -0.7 V [1, 3] indicating energically highly favorable for electron injection from the excited dyes into the conduction band of TiO_2. Moreover, the estimated LUMO energy of BiRu2 dye (-3.3 eV) is higher than the conduction band energy level of the TiO_2 (-4.0 eV) which is desirable for more efficient electron injection into CB of TiO_2 [4]. The DSSC based on BiRu2 achieves a conversion efficiency of 5.21%, which is 12% higher than that of the N3-sensitized solar cell under the same cell fabrication and efficiency measuring procedures (See I-V curve), which is attributed to the higher absorption coefficient in the visible region of specrum and lower $E_{1/2}$ of BiRu2 as a result of π-expanded ligand. Moreover, the improved J_{SC} and V_{OC} were caused by the avoided aggregation of BiRu2 dye, because of its bulky structure which could decrease the recombination and intermolecular charge transfer [3]. In conclusion, we prepared a new sensitizer, BiRu2, by incorporating naphthyl antennas into the ancillary ligands and investigated its potential as dye in DSSC device which shows the better performance respect to the N3. The improvement performance of DSSC device based on BiRu2 reveal the great potential of this dye for DSSC application in the future.



Keywords: π-Extended ligand, Dinuclear ruthenium (II) sensitizer, Dye sensitized solar cell

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