

Bis(1,10-phenanthroline) copper complexes with tailored molecular architecture: from electrochemical features to application as redox mediators in dye-sensitized solar cells.

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In the last few years, copper complexes turned out to be excellent competitors of cobalt complexes as redox mediators in the formulation of iodine-free electrolytes for dye-sensitized solar cells (DSSCs). The lack of a clear correlation between electrochemical signatures of copper complexes (*i.e.* half-wave potential and heterogeneous electron transfer rate) and photoelectrochemical performance of solar devices makes difficult the optimization of their coordination sphere. Therefore, to partially fill this gap and to elucidate the intrinsic correlation between the molecular architecture of these complexes and their electrochemical features, we prepared four Cu⁺²⁺ redox couples in which the copper center is coordinated by two 1,10-phenanthrolines with different substituents in position 2. These complexes were characterized, from both electrochemical and spectroscopic point of view, and tested as electron shuttles in photoelectrochemical cells sensitized with two efficient π -extended benzothiadiazole dyes. It appeared that 2-aryl-1,10-phenanthrolines effectively combine suitable optical and electrochemical properties. While a fast electron transfer kinetics seems to positively affect the dye regeneration process, a more balanced value leads to an increase of the overall DSSC performance.