Title: Hybrid electrolyte for highly efficient dye sensitized solar cells by addition of tri(p-alkoxyl)amine into cobalt electrolyte

Abstract: Redox electrolytes are of crucial importance for dye sensitized solar cells applications due to their central role in the charge transfers and ionic transport processes. Cobalt complex as redox mediator in the electrolyte has been a successful alternative than I^-/I_3^-, which maintain the record efficiency of dye sensitized solar cells, over 14 % under one sun illumination.[1] However, the kinetics of cobalt mediators are rather slow. To overcome this limitation of cobalt complex, we simply add the tris(p-anisyl)amine (TPAA), which show faster electron transfer kinetics, into a standard cobalt-based electrolyte. And impressively, a remarkable improvement of performance of dye sensitized solar cells was found, from 8.4 % to 10.5 % with a co-sensitizer.[2] Recently, we further modify TPAA with longer alkoxyl chain in the hybrid electrolyte. Combining with another single dye, 11 % of solar cell performance under one sun and 14 % under 0.3 sun was achieved. More surprisingly, almost 50 % improved performance of solar cells than that of cobalt based solar cells was shown, with high V_{OC}, around 1 V, 200 mV higher than that of cobalt mediator. The detailed characterizations confirm the faster dye regeneration by tri(p-alkoxyl)amine and slower recombination processes than the single cobalt electrolyte. We believe that this new hybrid electrolyte system can lead to the new record in dye sensitized solar cells.

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2. Y. Hao, W. Yang, L. Zhang, R. Jiang, E. Mijangos, Y. Saygili, L. Hammarström, A. Hagfeldt and G. Boschloo, 2016, **7**, 13934.