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色素増感太陽電池における電子注入ダイナミクスの電解液依存性：溶媒及び添加物効果

Effects of electrolyte on electron injection dynamics in dye-sensitized solar cells: Examination of solvents and additives.

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Dye sensitized solar cell (DSSC) has emerged as an alternative source of sustainable green energy. Electron injection is the first crucial elementary step in a DSSC, which is one of the key factors to determine the overall efficiency of DSSCs. The use of different additives and cations in the electrolytes is an effective way to enhance the overall efficiency of DSSC. The femtosecond transient absorption measurements were carried out to monitor the electron injection rate and efficiency in N719/TiO_2 system in presence of different electrolyte having typical additives and guanidine cation (Gu^+). Figure 1a and 1b show the transient time profiles of adsorbed N719 Ru-complex dye on TiO_2 at different concentration of additives [n-methyl benzimidazole (NMBI)] and Gu^+ salt in two different -CN containing solvents Benzonitrile (BzCN) and 3-Methoxypropyonitrile (MPN) respectively, using 532nm laser pulse excitation monitored at 800nm probe wavelength, which is dominantly the time profile of transient cation of N719. It was observed that changing the solvent from MPN to BzCN, keeping the concentration of all other additives invariant, resulted in higher electron injection efficiency in N719/TiO_2 system. It is also observed that the presence of Gu salt enhances the electron injection efficiency compared with samples of the base electrolytes (B1, M1) and those with NMBI additive (B2, M2) in both MPN and BzCN solvent possibly due to the downshift of conduction band edge energy of TiO_2. We have additionally examined effects of the concentration of additives and other counter anions of Gu salts as well as the device performance.

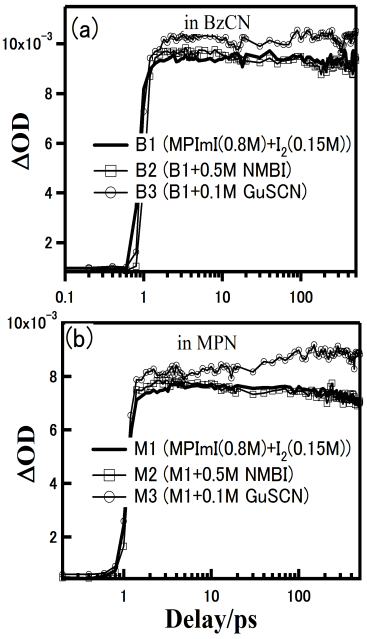

Figure1: Femtosecond transient time profiles of adsorbed N719 onTiO_2 system in different additive concentration (a) BzCN (b) MPN.

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