# 第144回 OPERA研究交流セミナー
# 第135回 ISIT有機光エレクトロニクス研究特別室セミナー
# 第202回 未来化学創造センターセミナー

**日時： 2016年3月7日（月） 15:00～**
**場所：九州大学 共進化社会システムイノベーション施設 2F大会議室**

## On the role of molecular charge transfer states in ultrafast photo-charge generation in solid-state dye sensitized solar cells

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The role of intermolecular charge transfer (CT) states in solid-state dye sensitized solar cells employing a perylene dye and metal-oxide electrodes are investigated comprehensivey employing (a) ultrafast transient absorption, (b) transient photoluminescence and (c) optical pump-THz probe spectroscopy techniques. Here we show that the presence of a molecular excited state with a strong charge-transfer character may be critical for charge generation when the total energy of the photoexcitation is too low to intercept accepting states in the TiO2 photoanode. Though hole transfer to the 2,2′,7,7′-tetrakis(N,N-di-p-methoxyphenylamine)-9,9′-spirobifluorene (Spiro-OMeTAD) can be very fast, an electron − hole pair is likely to form at the organic interface, resulting in a possible trap like excitation. This leads to poor photocurrent generation in the solid state DSSC (ss-DSSC) device. Combining the information obtained from the three complementary ultrafast spectroscopy techniques mentioned above, we find that the molecular exciton is stabilized in a low-energy CT state through efficient intramolecular electron transfer and if the metal oxide presents a significant energy barrier, the photoexcited state may remain trapped at the organic interface, though hole transfer from the dye to the Spiro-OMeTAD happens efficiently. This will lead to a loss in charge generation and hence low photo-current. We demonstrate that it is possible to overcome this issue by fabricating SnO2 -based ss-DSSC and performing similar spectroscopic analysis. We corroborate the above observation by fabricating and testing devices with both TiO2 and SnO2 photoanodes.

**主催：九州大学 最先端有機光エレクトロニクス研究センター**
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