Contribution ID: **285** Type: **Oral Presentation**

A Near Infrared Femtosecond Laser Source for Observation of Charge Transfer Processes in Semiconductors

Thursday, 2 July 2015 09:40 (20 minutes)

Abstract content
   (Max 300 words)
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Our group is investigating the charge dynamics within organic-Dye Sensitized Solar Cells (DSSC). In these particular solar cells the light absorber is an Indoline dye which acts as the donor whereas the acceptor is a semiconductor (ZnO). Previous studies in our group show that after photoexcitation the dye's electrons are injected into the semiconductor's conduction band. The injected electrons can then be probed within the ZnO conduction band using femtosecond infrared light pulses.

We were successfully able to generate infrared pulses tuneable between 0.9μm to 2.1μm. These pulses were produced with the use of a single-stage Noncollinear Optical Parametric Amplifier (NOPA) pumped by a 387nm pulses and seeded with a white light continuum (550nm-1300nm) generated from a (3mm)YAG crystal. In the NOPA the pump pulse was overlapped with a specific portion of the white light continuum inside a (3mm)BBO crystal to stimulate the splitting of the pump photons into two other photons; one with the same wavelength as the seeding signal λs and the other (the idler) with a wavelength λI determined by the energy conservation relation:

⅟λp=⅟λs+⅟λI,

where λp is the wavelength of the pump pulse (387nm). Conventionally, the seeded signal is used as a source of tuneable ultrashort pulses. In this work we used the idler as our source of the infrared signal. To study the charge dynamics in the DSSC we use femtosecond transient absorption spectroscopy with the probe pulses in the range of 1.5μm to 2μm.

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Session Classification: Photonics

Track Classification: Track C - Photonics