

Ultrafast spectroscopy of photoinduced charge-transfer reactions

Martin O. Lenz

University of Frankfurt, Germany
Institute for Physical and Theoretical Chemistry

Photoinduced charge transfer reactions play an important role in multiple natural systems, ranging from proton transfer processes for light sensing in bacteria to electron transfer reactions in proteins to fulfill their energy requirements like in the photosynthetic reaction center. By mimicking a natural cascade of electron transfer steps a new kind of solar cell has been developed, where an organic molecule absorbs light and an electron transfer to a colloidal semiconductor takes place (Grätzel-cell).

Different dyes have been utilized to maximize the photon-to-current-efficiency as well as to investigate the fundamentals of the electron transfer dynamics in these systems. They differ by spectral characteristics as well as by coupling strengths between the organic molecule and the semiconductor colloids.

To investigate the reaction dynamics after photoexcitation of a pure dye as well as the combined dye/semiconductor system ultrafast-time-resolved spectroscopy in the visible spectral range based on a pump-probe scheme has been used.

For one of these dyes (merocyanine) ultrafast photoinduced triplet formation could be observed. Upon coupling to the semiconductor a fast electron transfer as well as strongly reduced triplet formation could be monitored. Electron transfer characteristics and triplet formation for different merocyanine dyes will be discussed.