# Electron injection into localized $TiO_2$ acceptor states

## Scientific Achievement

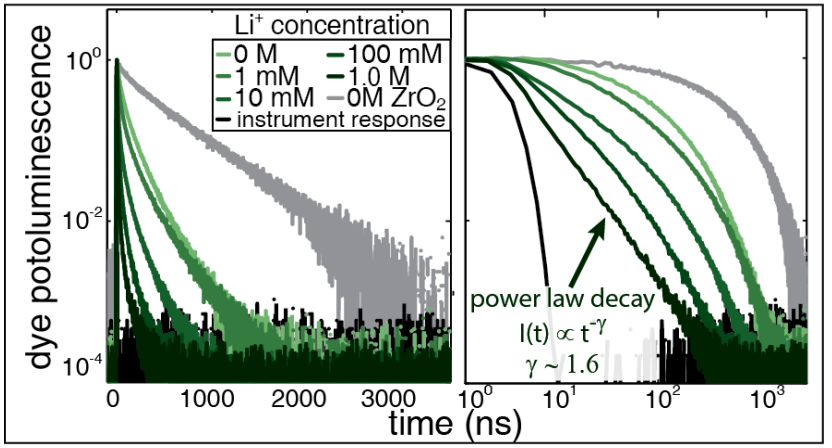
**Showed that dispersion in the time-resolved emission of dye-sensitized $TiO_2$ supports a model in which excited electrons are injected into localized sub-bandgap acceptor states.**

## Significance and Impact

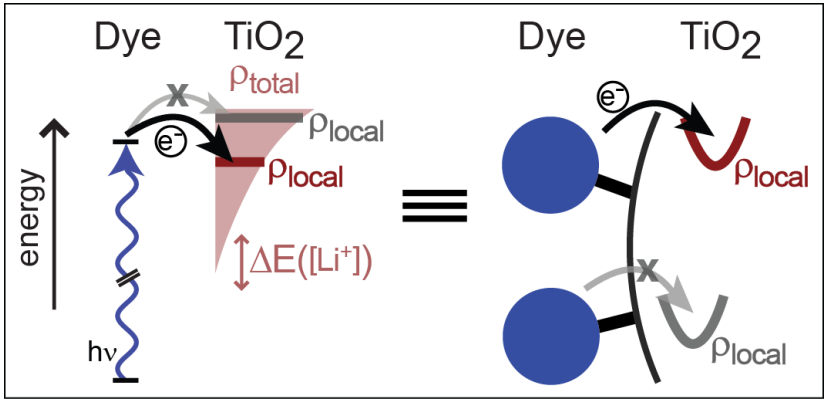
**Injection into localized semiconductor states explains the observed high rate of back electron transfer in conditions that favor strong injection, since electron transport between such states occurs via an inefficient hopping mechanism.**

## Research Details

- Photoluminescence of sensitized nanocrystalline films in various solvent conditions was observed by TCSPC.
- Emission exhibits a power law decay in time under conditions that strongly favor electron injection.
- Dispersive kinetics were analyzed using models that include an energetic distribution of injection barriers.
- Electrons are injected into localized $TiO_2$ acceptor states in the exponential distribution of sub-bandgap states, as opposed to injection into the conduction band.




Time-dependent photoluminescence of $TiO_2$ or $ZrO_2$ sensitized with a phosphonate-derivatized ruthenium (II) polypyridyl complex.




Chromophores are strongly coupled to only localized sub-bandgap acceptor states, resulting in a broad distribution of injection rates.

Power-Law Kinetics in the Photoluminescence of Dye-Sensitized Nanoparticle Films: Implications for Electron Injection and Charge Transport. Ian J. McNeil, Dennis L. Ashford, Hanlin Luo and Christopher J. Fecko. *J. Phys. Chem. C.* **2012**, *116*, 15888-15899, DOI: 10.1021/jp3030717.

Work was performed at the University of North Carolina

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