

Nanostructures, Dye-Sensitized Solar Cells, and Waste Water: Are There Bridges?

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After reviewing selected works on nanostructured surfaces done in Mülheim an der Ruhr, I will talk about two topics. First, I will describe our research on dye-sensitized solar cells (DSSCs). DSSCs represent an example of successful tuning of nanostructured surfaces in a practically important device. Although many researchers have worked in this field, our investigations gave strong indications that the mechanism behind these solar cells is not fully understood. A key method for the investigation of the details of the electron paths are electrical current transients (J -transients) following a laser excitation. In the last years, a sophisticated model for their description has been established. However, this model turns out to be in contradiction with a number of our experimental findings such as the J -transient shape and the signal dependences on experimental parameters. It is especially remarkable that there are always delays of the electrical signal after the laser excitation and that the possible diffusion times do not follow an Einstein diffusion relation which is a-priori assumed in many works.[1]

In the last part of my talk I will discuss aspects from solar cell research which are of relevance for the design of new catalysts. They involve the tuning of electron paths, exploration of nanostructured interfaces and new analysis methods. Fields of potential application are chemical synthesis and waste water treatment.

[1] F. Marlow, A. Hullermann, L. Messmer: Is the Charge Transport in Dye-sensitized Solar Cells Really Understood? *Adv. Mater.* 27 (2015) 2447–2452

Frank Marlow studied physics at the HU Berlin and completed his PhD on energy transfer phenomena in molecular systems in 1988 in the research group of Werner Ebeling. He was a Postdoc at the Institute of Physical Chemistry of the former Academy of Sciences in Berlin, at the FU Berlin, and at the Institute of Applied Chemistry Berlin-Adlershof. There he worked on non-linear optics at surfaces and host-guest compounds. In 1993 he received the Leopoldina-Förderpreis. In 1998 he was a visiting researcher at Galen Sucky's group in UC Santa Barbara. There he started to work with mesoporous materials. He completed his Habilitation in Physical Chemistry at the FU Berlin in 1999. Also in 1999, he joined the Max-Planck-Institute für Kohlenforschung where he leads the research group "Nanostructures and Optical Materials". He is Privatdozent at the University of Duisburg-Essen and published about 150 research works.