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Thermal degradation chemistry of ruthenium complexes in the dye-sensitized solar cell and strategies for reducing the dark current

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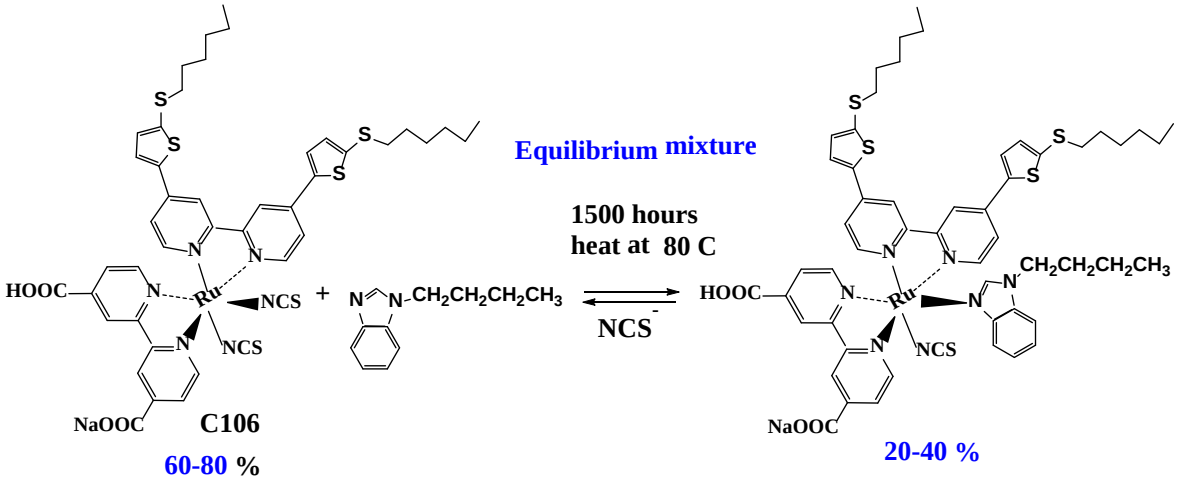
Abstract. In the last decades dye-sensitized solar cells (DSCs) have extensively been studied. From an economical point of view, DSCs are of high interest because the manufacturing costs of DSCs devices are significantly lower compared with other solar devices such as silicon cells. One of the success criteria required for commercial use of DSCs is high stability under light soaking and thermal stress conditions. The dye sensitizer is one of the key components of a DSC device. Consequently, the stability of DSCs is directly linked to the dye stability, which is in turn linked to its degradation on the surface of a semiconductor anode (TiO_2). In my lecture, I will present and overview of our degradation investigations of the ruthenium dyes N719, Z907 and C106 with the general structure $RuLL´(NCS)_2$ and show how detailed degradation mechanistic knowledge is important in the developing of DSC cells with improved thermal dye stability [1,2]. In my talk, I will also include a brief account of our recent work on the development of new methods for reducing the dark current in DSCs prepared with one-electron mediators as ferrocenium/ferrocene and Co^{II}/Co^{III} complexes. In order to reduce the back electron transfer from the photo anode to the mediator R^+ and the oxidized dye S^+ we have applied electrochemical grafting strategies to attach an electrical isolation layer of mono and multilayers of organic molecules on the TiO_2 photo anode [3].



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