

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

Lund, Torben

*Publication date:*  
2017

*Document Version*  
Publisher's PDF, also known as Version of record

*Citation for published version (APA):*  
Lund, T. (2017). *Thermal degradation chemistry of ruthenium complexes in the dye-sensitized solar cell and strategies for reducing the dark current*. Paper presented at 21st International Conference of Solid State Ionics , Padua, Italy.

### General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain.
- You may freely distribute the URL identifying the publication in the public portal.

### Take down policy

If you believe that this document breaches copyright please contact [rucforsk@kb.dk](mailto:rucforsk@kb.dk) providing details, and we will remove access to the work immediately and investigate your claim.

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

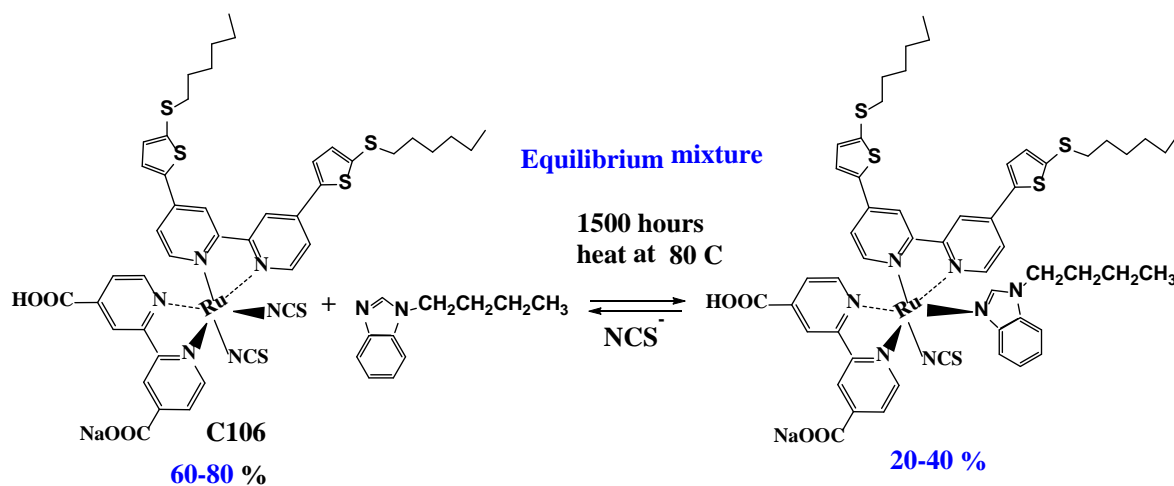
Torben Lund<sup>(a)\*</sup> and Phuong Tuyet Nguyen<sup>(a),(b)</sup>

<sup>(a)</sup>Department of Science and Environment, Roskilde University, DK-4000, Denmark

<sup>(b)</sup> Faculty of Chemistry, University of Science, Vietnam National University – Ho Chi Minh City, Vietnam

Corresponding author: [tlund@ruc.dk](mailto:tlund@ruc.dk)

**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<sub>2</sub>). In my lecture, I will present an overview of our degradation investigations of the ruthenium dyes N719, Z907 and C106 with the general structure RuLL'(NCS)<sub>2</sub> 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<sup>II</sup>/Co<sup>III</sup> complexes. In order to reduce the back electron transfer from the photo anode to the mediator R<sup>+</sup> and the oxidized dye S<sup>+</sup> we have applied electrochemical grafting strategies to attach an electrical isolation layer of mono and multilayers of organic molecules on the TiO<sub>2</sub> photo anode [3].



## References

[1] P. T. Nguyen, P. E. Hansen, T. Lund, The effect of 4-tert-butylpyridine and Li<sup>+</sup> on the thermal degradation of TiO<sub>2</sub>-bound ruthenium dye N719, *Solar Energy* 88 (2013) 23–30.

[2] T. Lund, P. T. Nguyen, H. M. Tran, P. Pechy, S. M. Zakeeruddin, M. Grätzel, Thermal stability of the DSC ruthenium dye C106 in robust electrolytes, *Solar Energy*, 110 (2014) 94-104.

[3] T. Lund, P. T. Nguyen, T. Ruhland “Electrochemical grafting of TiO<sub>2</sub>-based photo-anodes and its effect in dye-sensitized solar cells” *Journal of Electroanalytical Chemistry* 758 (2015) 85–92.

