AUSTRIAN INSTITUTE OF TECHNOLOGY
TOMORROW TODAY

CEST

BIOELECTROCHEMISTRY AND MORE

AN INTERNATIONAL WORKSHOP, JUNE 13TH TO 14TH 2016
CEST/WIENER NEUSTADT

Registration is requested
until June, 9th 2016
at office@cest.at

www.ait.ac.at
www.cest.at

Technopol Wr. Neustadt
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The **AIT Austrian Institute of Technology** and **CEST**
invite you to the lecture series:

BIOELECTROCHEMISTRY AND MORE

Date **Monday, 13th June 2016 – Tuesday, 14th June 2016**

Location **Lecture Hall TFZ, 1st floor, Unit A**
CEST Centre of Electrochemical Surface Technology
Viktor-Kaplan-Straße 2, 2700 Wiener Neustadt
phone: +43-2622-222266-0 | fax: +43-2622-22266-50
mail: office@cest.at | www.cest.at

Monday, June 13th
All Morning: arrival of workshop speakers

08:30 **Mounting of Posters**
09:00 **PhD Student Seminar with Poster Session**
11:30 **Lunch**
12:30 **Welcome**
Christoph Kleber (CEST)
Wolfgang Knoll (AIT Austrian Institute of Technology GmbH)
Michael Klosterer (Stadt Wiener Neustadt)
12:40 **Organic Bio-Electronic Sensors for Ultra-Sensitive Detection**
Luisa Torsi
13:20 **Dielectric and Semiconductor Surface Interfacial Interactions for Biomimetic Integrated Nanosystems Based on Solid-State Nanopores: Nanofluidic-Enabled "Iontronic" Transduction of Biological, Chemical and Physical Stimuli**
Omar Azzaroni
14:00 **Interfacing with the Brain Using Organic Electronics**
Georges Malliaras
14:40 **Coffee and Posters**
15:30 **Analysis of Molecules and Macromolecules at Electrolyte/Solid Interfaces – Interface Chemistry, Self-Organization and Interfacial Forces**
Guido Grundmeier
16:10 **Detection of Unlabeled Biomolecules Using Simplified Reflective Interferometry**
Lewis Rothberg
16:50 **Electrochemical Biosensor Systems for POC Diagnostics**
Martin Weber
17:30 **A Decaheme Cytochrome as a Molecular Electron Conduit in Dye-Sensitized Photoanodes**
Lars J. C. Jeuken
18:10 **End of Lecture Day 1**

Tuesday, June 14th
Lecture Hall TFZ, 1st floor, Unit A

09:00 **Biosensing for Molecular Diagnostics: Current Trends and Perspectives**
Maria Minnuni
09:40 **Coupling and monitoring chemical fluxes of microstructured enzyme layers**
Gunther Wittstock
10:20 **Ultra-Sensitive System to Detect Minute Ionic Gradients within Glioma Cells**
Paulo Rocha
11:00 **Coffee**
11:30 **Semiartificial Photosynthesis. How to Wire Photosystem 1 and 2 to Electrodes**
Wolfgang Schuhmann
12:10 **Selective and Reversible Ion-Detecting Sensor Elements in Aqueous Environment Based on Organic Electronic Devices**
Emil J.W. List-Kratochvil
12:50 **Lunch and Posters**
13:30 **Mechanical and optical sensing of biological systems using thin film electronics**
Ioannis Kymissis
14:10 **Bioelectronic Nose and Tongue: Integration of Human Receptors and Nano Devices**
Tai Hyun Park
14:50 **Electronic Plants**
Magnus Berggren
15:30 **Closing Remarks**
16:10 **End (Lab Tour optional)**

PhD Workshop „bioelectrochemistry and more....." 13. Juni 2016

8.30 – Anbringen der Poster

9.00 Beginn – ca. 3 min Kurzpräsentation, im Anschluss an die Präsentationen Diskussion an den Postern

9.00: Stefan Ziebermayr

9.05: Beate Stallinger

9.10: Jie Sun

9.15: Gabriela Schimo

9.20: Christina Bliem

9.25: Georg Hölzl

9.30: Andreas Sikora

9.35: Markus Nadlinger

9.40: Lisa Mayerhuber

9.45: Esteban Piccinini

9.50: Johannes Bintinger

9.55: Sebastián Alberti

10.00: Jan Hrbac

10.05: Cezarina Mardare

10.10: Patrik Aspermair

10.15: Andreas Geiss

10.20: Florian Glöcklhofer

10.25: Paul Kautny

10.30: Thomas Kader

ab 10.35: Diskussion an den Postern

11.30: Pause

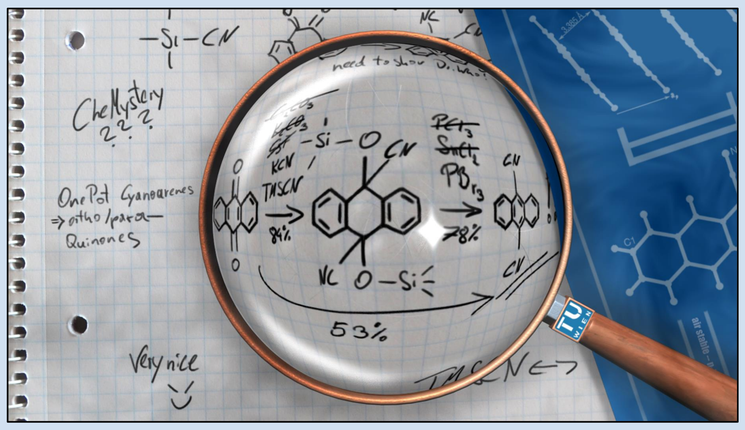
Air-Stable Multi-Cyanated Acenes – A Novel Synthesis Paving the Way for Cyanated Functional Materials

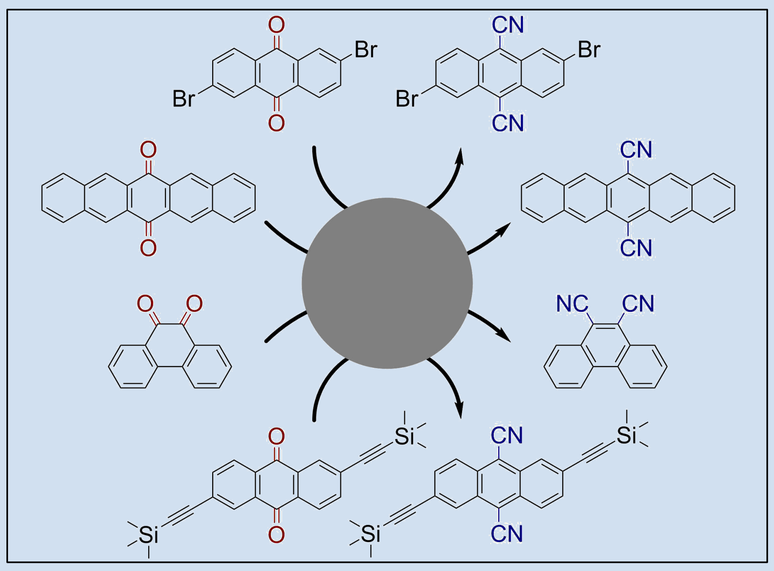
F. Glöcklhofer,[1]* M. Lunzer,[1] B. Stöger,[2] J. Fröhlich[1]

[1] Institute of Applied Synthetic Chemistry, [2] Institute of Chemical Technologies and Analytics, TU Wien, Vienna, Austria

Objectives

- Developing a facile **new synthesis** of cyanated acenes
- Preparing cyanated pentacenes for **air-stable n-type transistors**
- Shifting solid-state emission of cyanated anthracenes by **sterically hindered substituents**





The novel synthesis

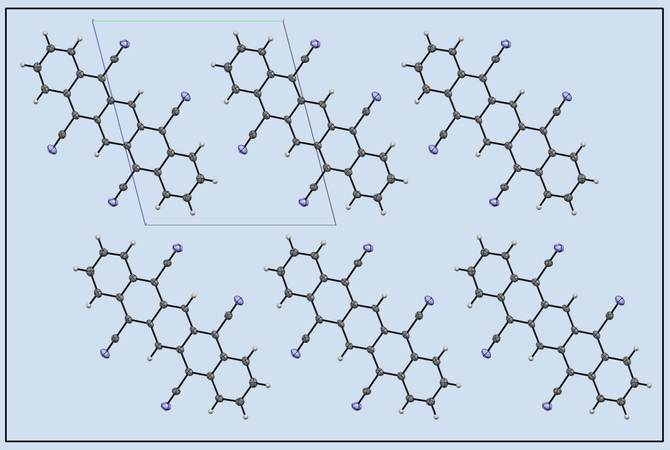
- *Ortho*- and *para*-quinones as starting materials
- **First step:** formation of silylated cyanohydrin intermediates using trimethylsilyl cyanide (TMSCN) as reagent and KCN or LiCN as catalyst
- **Second step:** reductive aromatization using PBr_3
- Carried out in a **one-pot reaction**
- Overall yields ranging from 30% to 79%

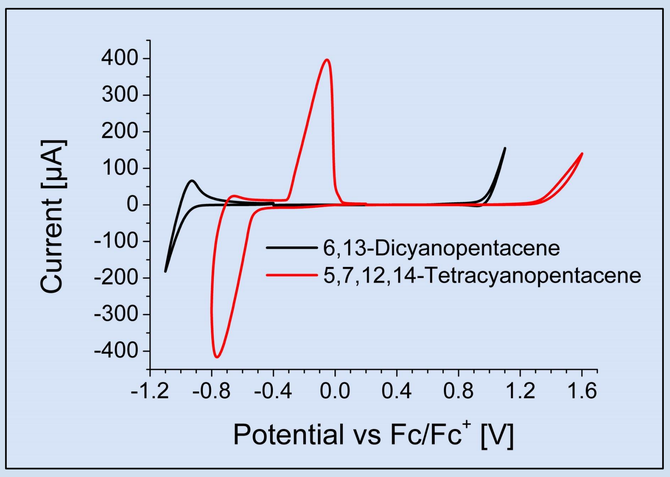
Cyanated pentacenes for n-type transistors

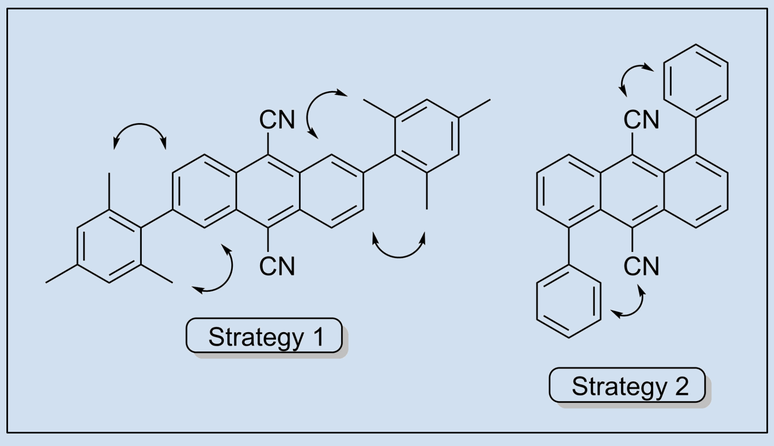
A **high electron affinity / low LUMO level** is one of the prerequisites for excellent materials for n-type transistors. This can be achieved by electron withdrawing substituents such as cyano groups, which can be introduced by the newly developed reaction and which were found to significantly lower the HOMO and LUMO levels of pentacene:

Pentacene: -4.88 eV ($HOMO_{cv}$), -2.70 eV ($LUMO_{opt}$)
6,13-Dicyanopentacene (DCP): -5.78 eV ($HOMO_{cv}$), -3.84/-4.16 eV ($LUMO_{cv/opt}$)
5,7,12,14-Tetracyanopentacene (TCP): -6.14 eV ($HOMO_{cv}$), -4.27/-4.54 eV ($LUMO_{cv/opt}$)

Both compounds were prepared from the corresponding quinones in one-pot reactions and are **air-stable**. LUMO levels below -4.1 eV are expected to result in stable transistors even during operation under ambient conditions. Thermal stability was observed up to 340°C for DCP and 400°C for TCP.
The reduction of TCP during cyclic voltammetry (CV) was found to be **highly reversible**.







Cyanated anthracenes for light emission

- Introduction of **phenyl and mesityl substituents** to obtain a twisted molecular configuration
- Decreased intermolecular interactions, less red-shifted solid-state emission
- Both strategies successful, detailed evaluation pending
- Synthesis by Suzuki coupling dicyanoanthracene triflates and phenyl/mesityl boronic acids

Conclusion and Outlook

A new synthesis of cyanated acenes has been developed and will pave the way for cyanated functional materials.
Promising materials for n-type transistors were obtained by employing this new synthesis to introduce the electron-withdrawing cyano groups.
The emission properties of cyanated anthracenes were successfully tuned by sterically hindered substituents.
Our results will guide future investigations towards ambipolar light-emitting materials featuring a dicyanoanthracene core and electron-rich substituents.

F. Glöcklhofer, M. Lunzer, J. Fröhlich, *Synlett* **2015**, *26*, 950-952.
F. Glöcklhofer, M. Lunzer, B. Stöger, J. Fröhlich, *Chem. - Eur. J.* **2016**, *22*, 5173-5180.

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