

Research on Organic and Hybrid Photovoltaics within the MATEOH-PV consortium

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What is MATEOH-PV?



- Network on MAterials and TEchnologies for Organic and Hybrid PhotoVoltaics (www.mateohpv.fr)
- Created in 2009 and supported by the Region Alsace (PMNA)
- 14 research teams in chemistry, physics and semiconductor devices from Strasbourg, Mulhouse and Nancy
- Covered TOPIC: *from design and synthesis of functional materials to the development of organic and hybrid PV devices*



Our Mission

- Foster the local Organic & Hybrid PV community
 - benefit from complementary expertises and common goal
- Organize workshops and conferences
 - 2d Workshop on OPV & DSSC: 24/09/2010
 - Conference on π -conjugated materials and nanostructures (MNPC), 03-07/10/2011 Obernai.
- Share research platform and specific equipments
- Trigger collaborations among network members

Main activities

- Organic D/A bulk heterojunctions (BHJ)
- Hybrid D/A BHJ
- Dye-sensitized solar cells
- Solar batteries
- (Semi)conducting transparent oxydes

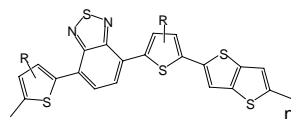
Major expertises and facilities

- Chemistry of materials
 - Synthesis of conjugated polymers, molecular dyes, metallo-organic compounds, fullerenes, fonctionnalized CNT, organo-gelators, nanostructured ZnO, ionic liquids.
- Material characterization
 - Thin film nanostructure (cryo-TEM, electron diffraction AFM, XRD)
 - Optoelectronic properties (TOF, SCLC, OFET)
 - Charge carrier dynamics (transient absorption spectroscopy)
- Devices
 - Elaboration & characterization under controlled atmosphere
 - Device modelling

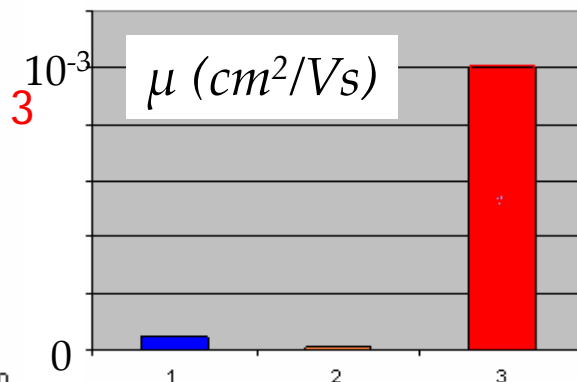
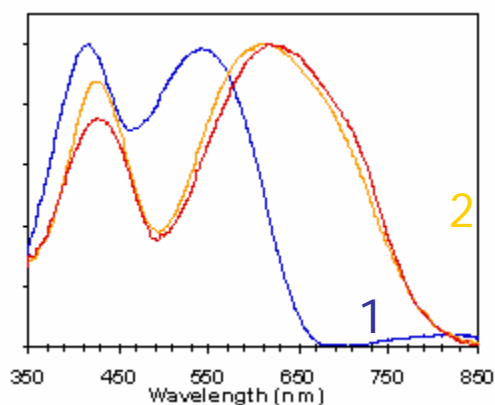
Scientific highlights

Scientific highlights

- Polymer/fullerene BHJ (N. Leclerc, P. Lévêque, T. Heiser)
 - D/A-alternate copolymers
 - GOAL: optimized HOMO/LUMO levels (absorption and V_{OC}) and charge mobility



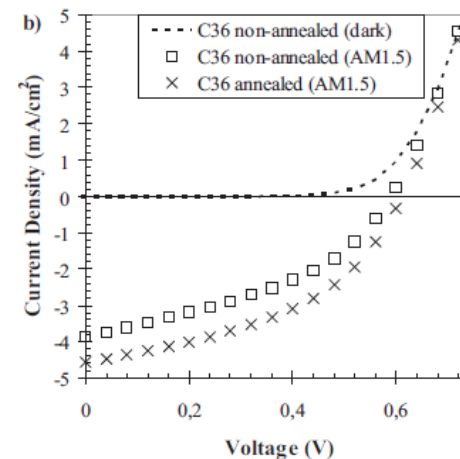
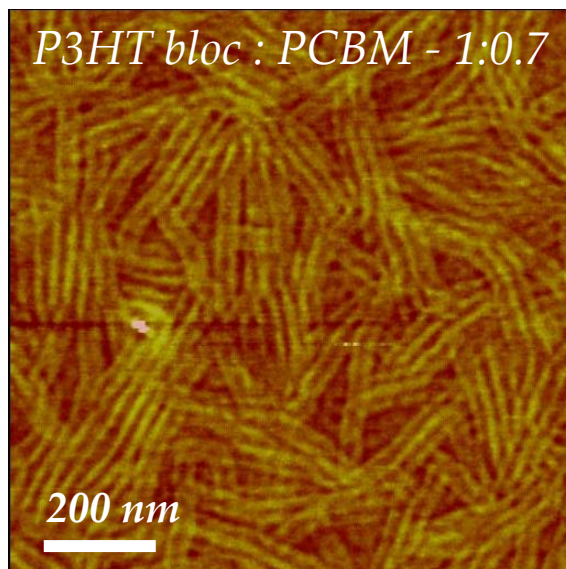
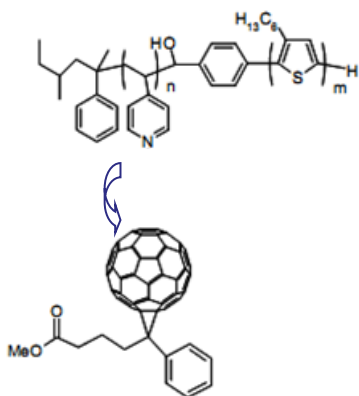
1, 2, 3 : same conjugated backbone, different side chains (position, nature)



L. Biniek, et al. *Macromol Rapid Com*, 31 (2010) 651

Scientific highlights

- Polymer/fullerene BHJ (N. Leclerc, P. Lévêque, T. Heiser)
 - Block-copolymer based photovoltaic materials and devices
 - GOAL: optimized and stable BHJ morphology



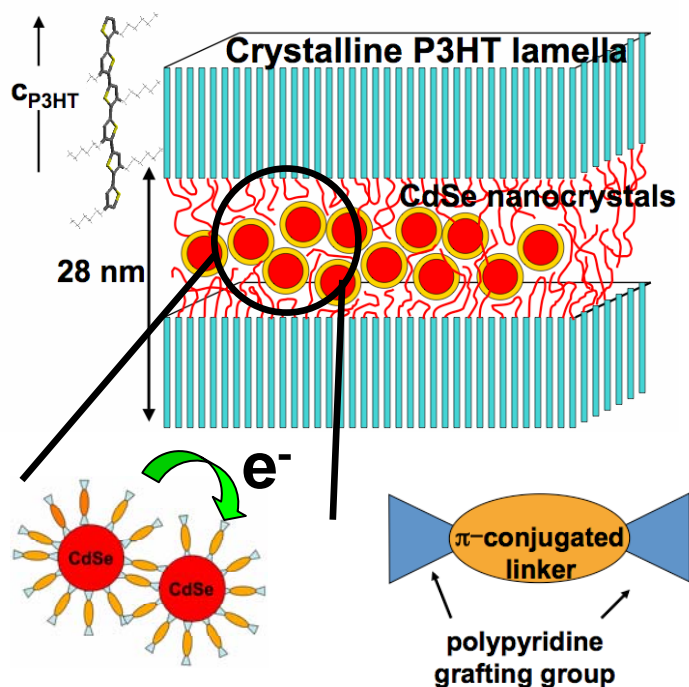
$$\eta = 1,6\%$$

[in coll.: R. Mezzenga (U. Fribourg, CH), S.Berson (CEA)]

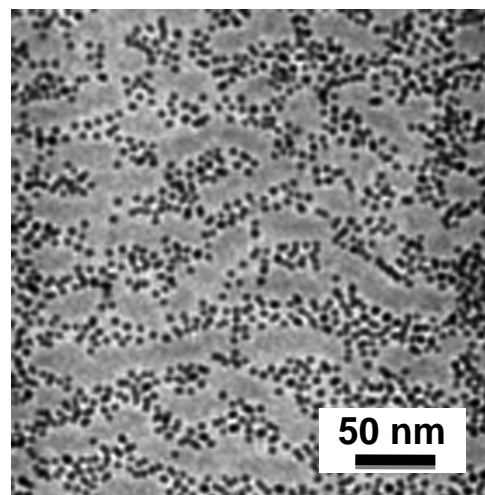
N. Sary et al. *Adv.Mat.*22 (2010) 763

Scientific highlights

- Polymer/CdSe hybrid BHJ (M. Brinkmann)
 - Elaboration of hybrid materials for photovoltaics in thin films with controlled structure and morphology



Nanostructured hybrid material
(TEM bright field): P3HT+FePt nanospheres



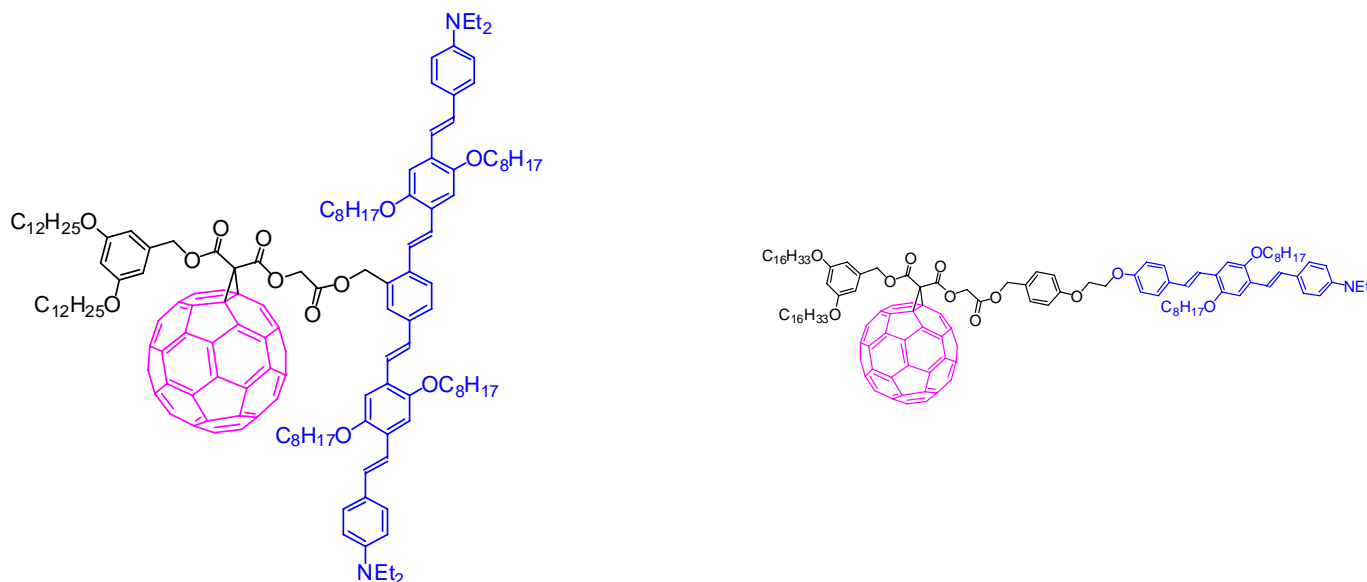
[in coll: CEA, PPSM (Cachan)]

Brinkmann M. *Adv. Mat.* 2006, 18, 860

Scientific highlights

- Fullerene based D/A dyades (*J.F. Nierengarten*)

GOAL: Investigate CT / ET versus molecular structure

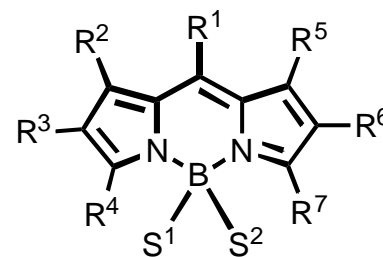
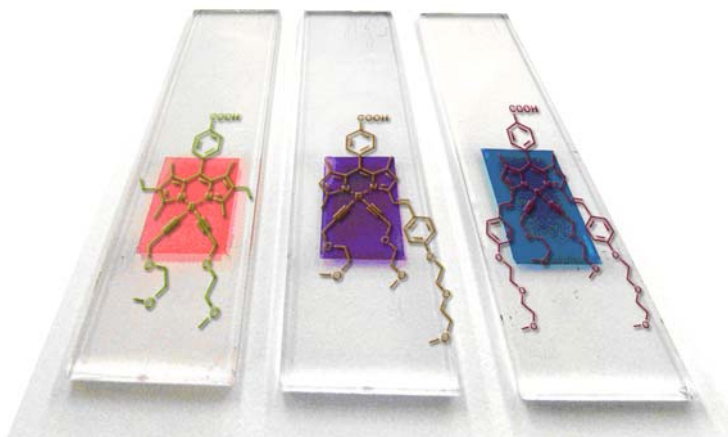


Chem. Eur. J. 2009, 15, 8825

New J. Chem. 2009, 33, 2174

Scientific highlights

- Molecular donor for organic PV (*R. Ziessel, G. Ulrich*)
 - BODIPY dyes (large color range)
 - GOAL: better photon harvesting (multiple dyes)
- DSSC

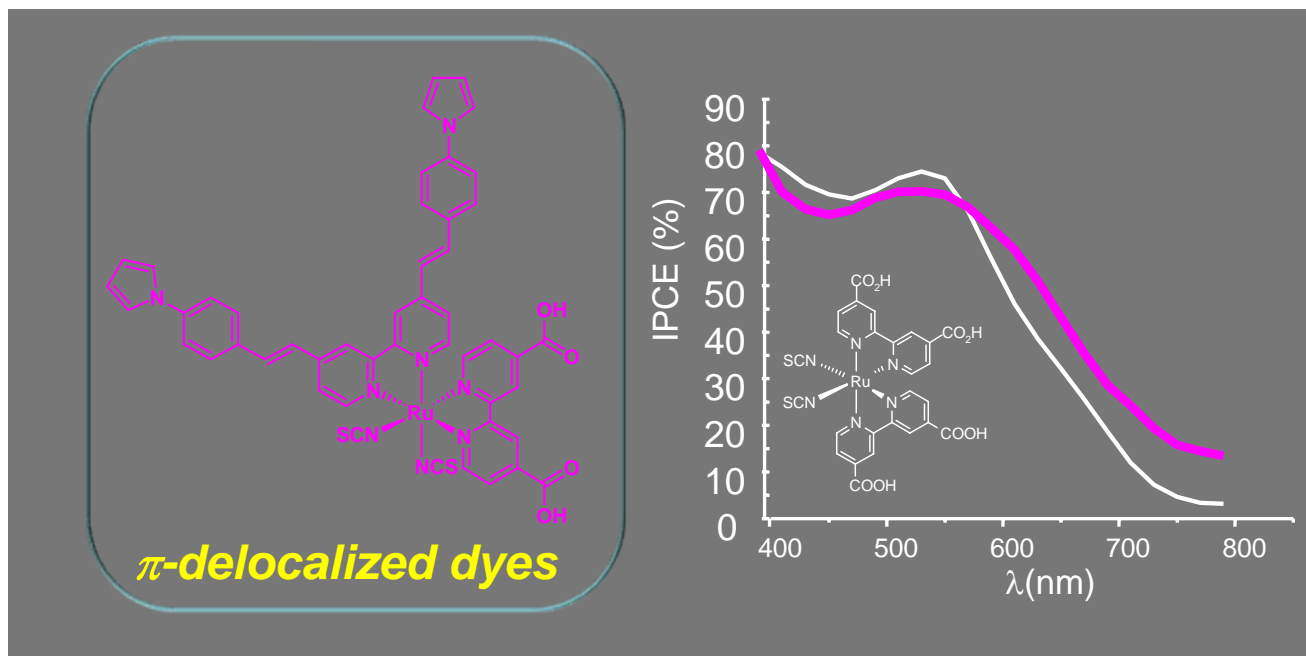


[in coll.: *J. Roncali (U. Angers)*], *R. Thummel (U. Houston)*

T. Rousseau, & al. J. Mater. Chem., 2009, 19, 2298
D. Kumaresan & al Chemistry Eur. J. 2009, 15, 6335

Scientific highlights

- DSSC (P. Gros, M.Beley)
 - GOAL: new dyes for slower recombination, wider absorption range, higher absorption coefficient

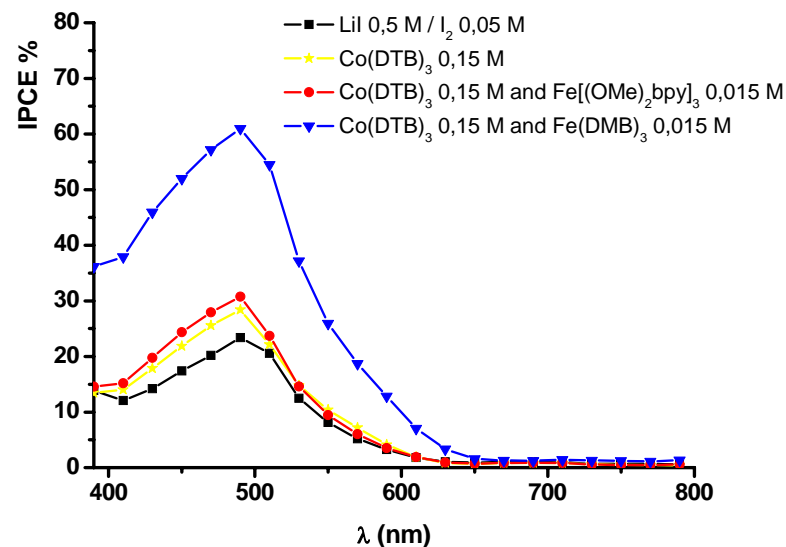
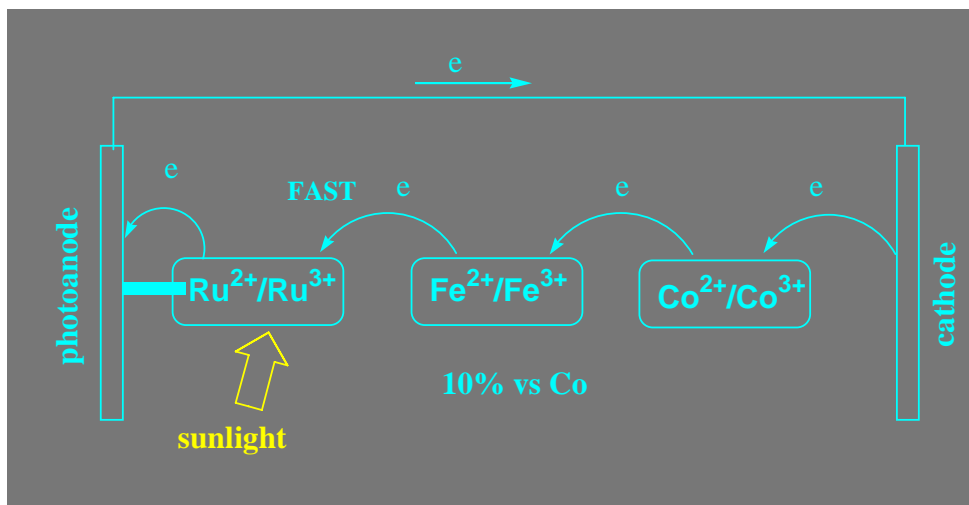


[in coll.: U. Ferrara]

Dalton Trans. 2009, 63

Scientific highlights

- DSSC (P. Gros, M. Beley)
 - GOAL: New redox mediators – non corrosive, slower recombination, weak visible absorption, faster regeneration, modulation of electronic properties

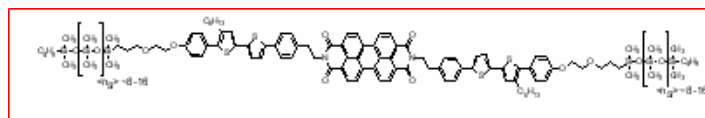


[in coll.: U. Ferrara]

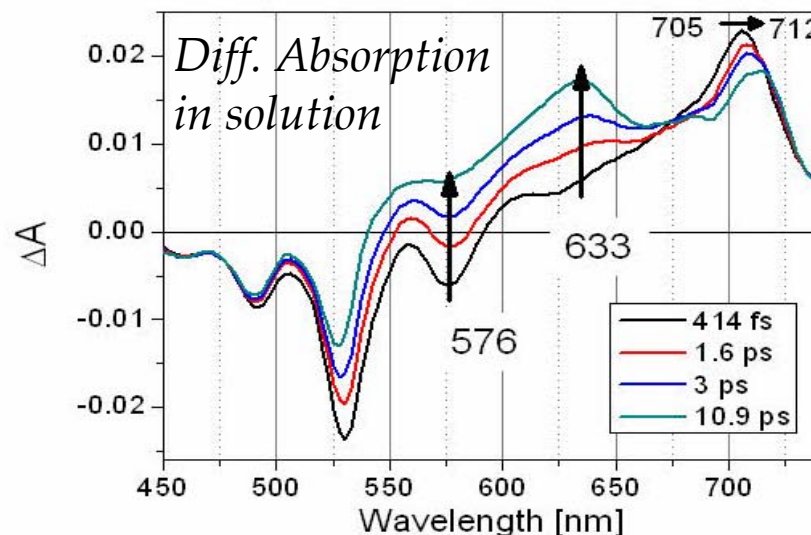
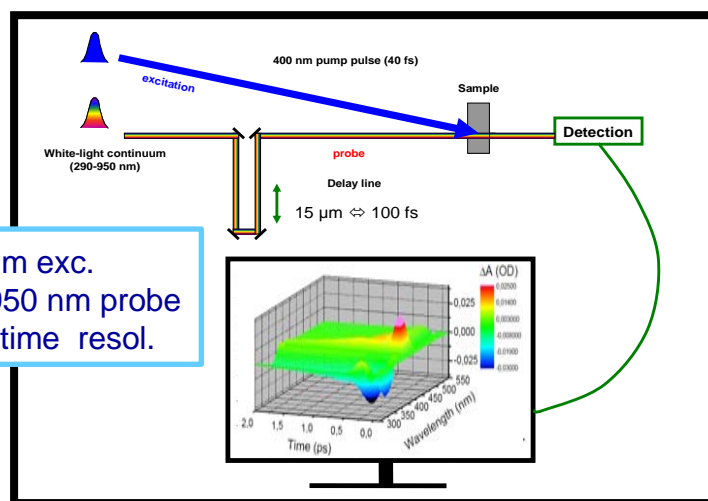
Chem. Eur. J. 2010, 2611

Scientific highlights

- Ultrafast transient absorption spectroscopy on D-A-D oligomers
(S. Haacke, J. Léonard, S. Mery)



- GOAL: Understand intramolecular charge transfer dynamics



Mateoh-PV teams and expertises



- N. Leclerc (LIPHT)- Conjugated polymer synthesis
- R. Ziessel, G. Ullrich (LCOSA-ECPM) – Molecular dyes synthesis
- S. Mery (IPCMS) - Synthesis of nanostructured semiconducting DAD smectic liquid crystalline material
- P. Gros, M. Beley (SOR -U. Nancy) - Synthesis of dyes and redox mediators (DSSC)
- J.F. Nierengarten (LCMM-ECPM) – Synthesis of advanced fullerene materials
- P. Petitm F. Schosseler (ICS) – Synthesis of functional CNT
- A. Carton, G. Pourroy (IPCMS) – Synthesis of nanostructured ZnO layers
- A. Dinia (IPCMS) –TCO layers obtained by sputtering
- J.L. Rehspringer (RBnano) – TCO from wet processable metallorganic precursors
- R. Welter (I. Chimie - UdS) – Synthesis of Ferric metallorganic compounds for solar battery applications
- D. Ivanov (IS2M) – XRD, AFM investigations of organic materials
- B. Brinkmann (ICS) – TEM, AFM investigations and processing of conjugated polymers
- S. Haacke, J. Léonard (IPCMS) – Transient absorption spectroscopy
- T. Heiser, P. Lévêque (InESS) – FET and PV devices. Charge transport investigations