



PHOTOVOLTAIC WINDOWS

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ORGANEXT CLOSING SYMPOSIUM



OUTLINE

Part 1:

- ▶ Intro organic solar cells
- ▶ Unique assets
- ▶ Application areas

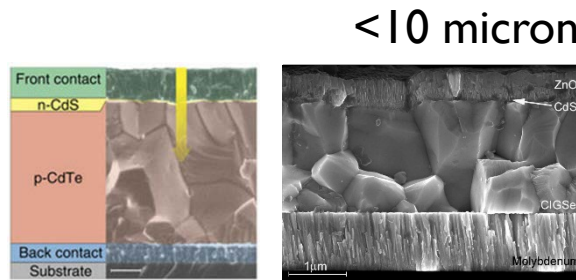
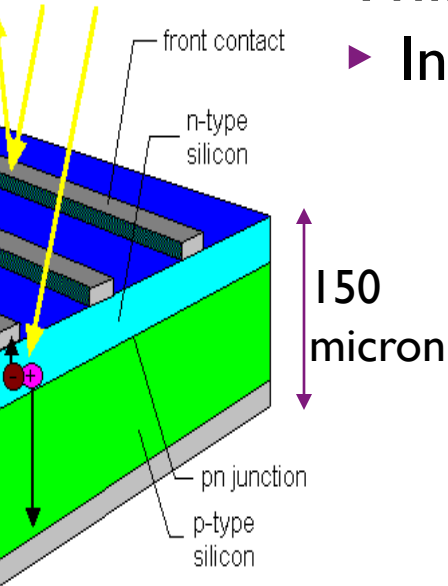
Part 2:

- ▶ Project results demonstrator

THIN-FILM PHOTOVOLTAICS

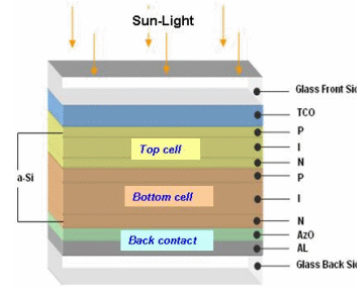
Thin, thinner, thinnest ...

- Industry-ready and emerging technologies

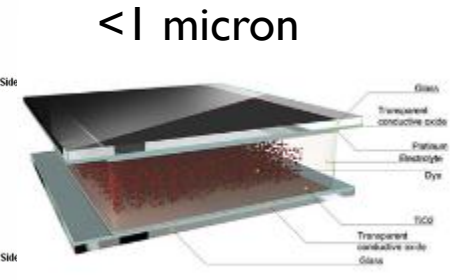


CdTe

CIGS



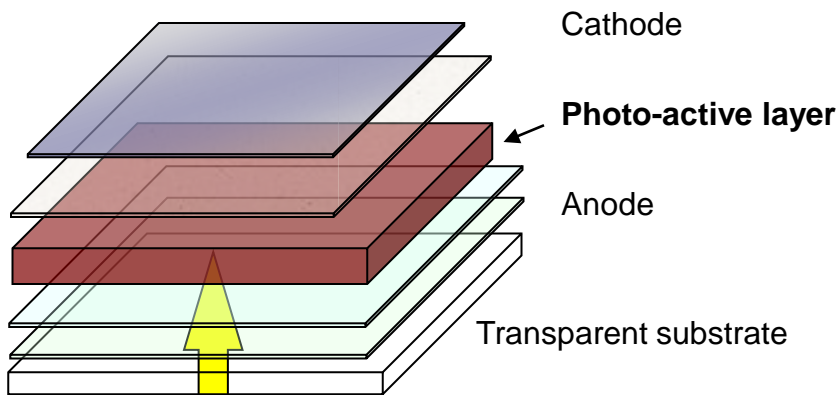
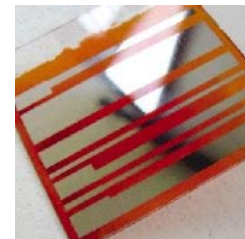
a-Si



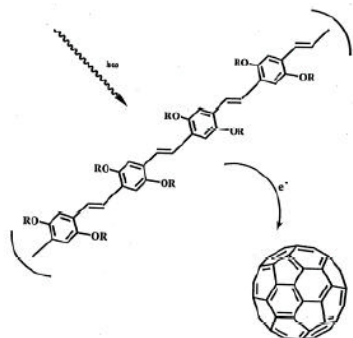
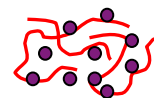
H&OPV

Source: SolarPrint

ORGANIC SOLAR CELLS

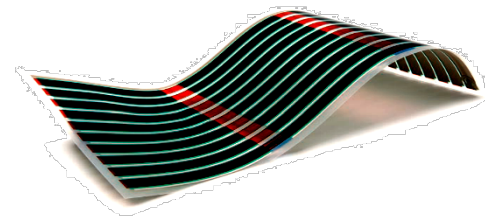


Donor/acceptor
blend or bilayer



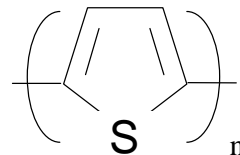
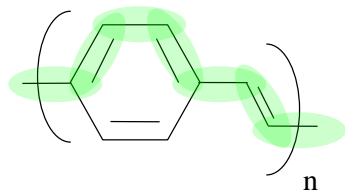
G. Yu et al, Science, 1995
J.J.M. Halls et al, Nature, 1995
N. S. Sariciftci et al, Science, 1992

ORGANIC SOLAR CELLS



Carbon based

- ▶ abundant material
- ▶ sp^2 -hybridization leads to semiconductor properties



conjugated **POLYMER**

STRENGTHS OF OPV

Mobile due to low weight

- ▶ e.g. plastic substrates
- ▶ < 1 micron total device thickness

Broad operational area

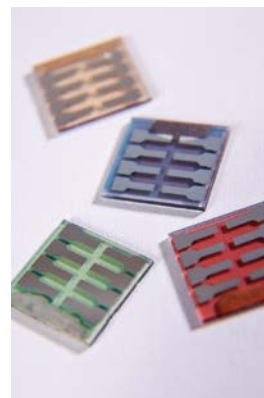
- ▶ operates well under low light conditions
- ▶ low incident angle dependence

Low thermal budget processes

- ▶ Printing, coating

Esthetics

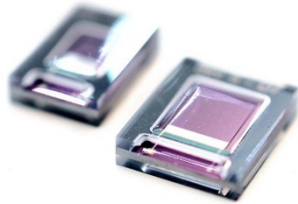
- ▶ large design freedom
- ▶ **color tunable**
- ▶ **semi-transparent**
- ▶ flexible/formable



APPLICATION AREAS

Automotive

SAND



© imec



Fastly deployable

Building integrated

BIPV

= multi-functional PV component: fulfills all functions required as a building component

+ generates electricity

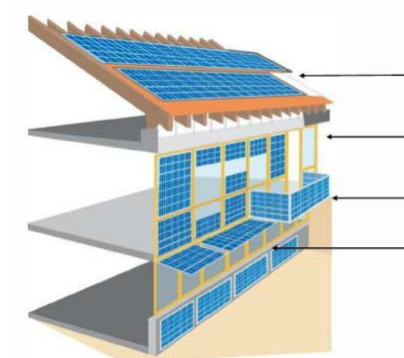
Driven by:

Energy efficiency and saving measures by:

▶ EU

- EU directive 2010/31 on energy performance of buildings:
- Member States shall ensure that:
 - (a) by 31 December 2020, all new buildings are nearly zero- energy buildings; and
 - (b) after 31 December 2018, new buildings occupied and owned by public authorities are nearly zero-energy buildings

▶ National states: e.g. Germany (“Energy Saving Order” (EnEV), France (RT2012), ...



FROM PASSIVE HOUSES TO PLUS-ENERGY BUILDINGS

Passive houses:

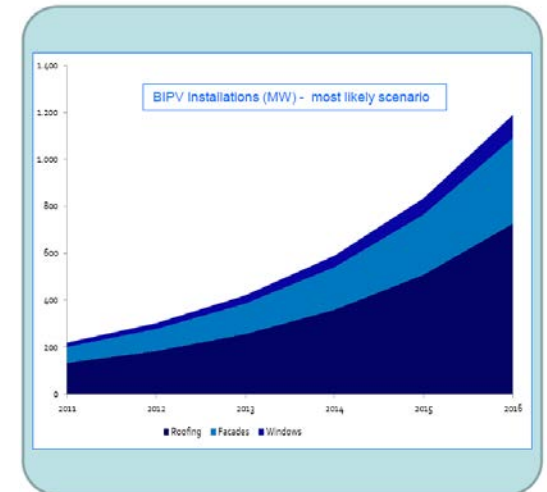
- ▶ Performance: < 15 kWh (1.5 l fuel) per m² per year

to Plus-Energy Buildings

- ▶ = Buildings which generate a surplus in the annual balance of final energy and primary energy
- ▶ How?
 - Solar thermal + long-term heat storage
 - Combined with photovoltaics + electricity storage (battery)

Market potential:

- ▶ World flat glass market for facades (opaque + transp) = 6 bn m² (2010)
- ▶ = 600 GW_p PV capacity/year



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