



ASSOLOMBARDA

Polimeri innovativi per fotovoltaico organico polimerico

Dipartimento di Chimica

Università degli Studi di Pavia

Gruppo di Ricerca: *Materiali Organici, Polimerici e Supramolecolari*

Website: www.unipv.it/labt

Speaker

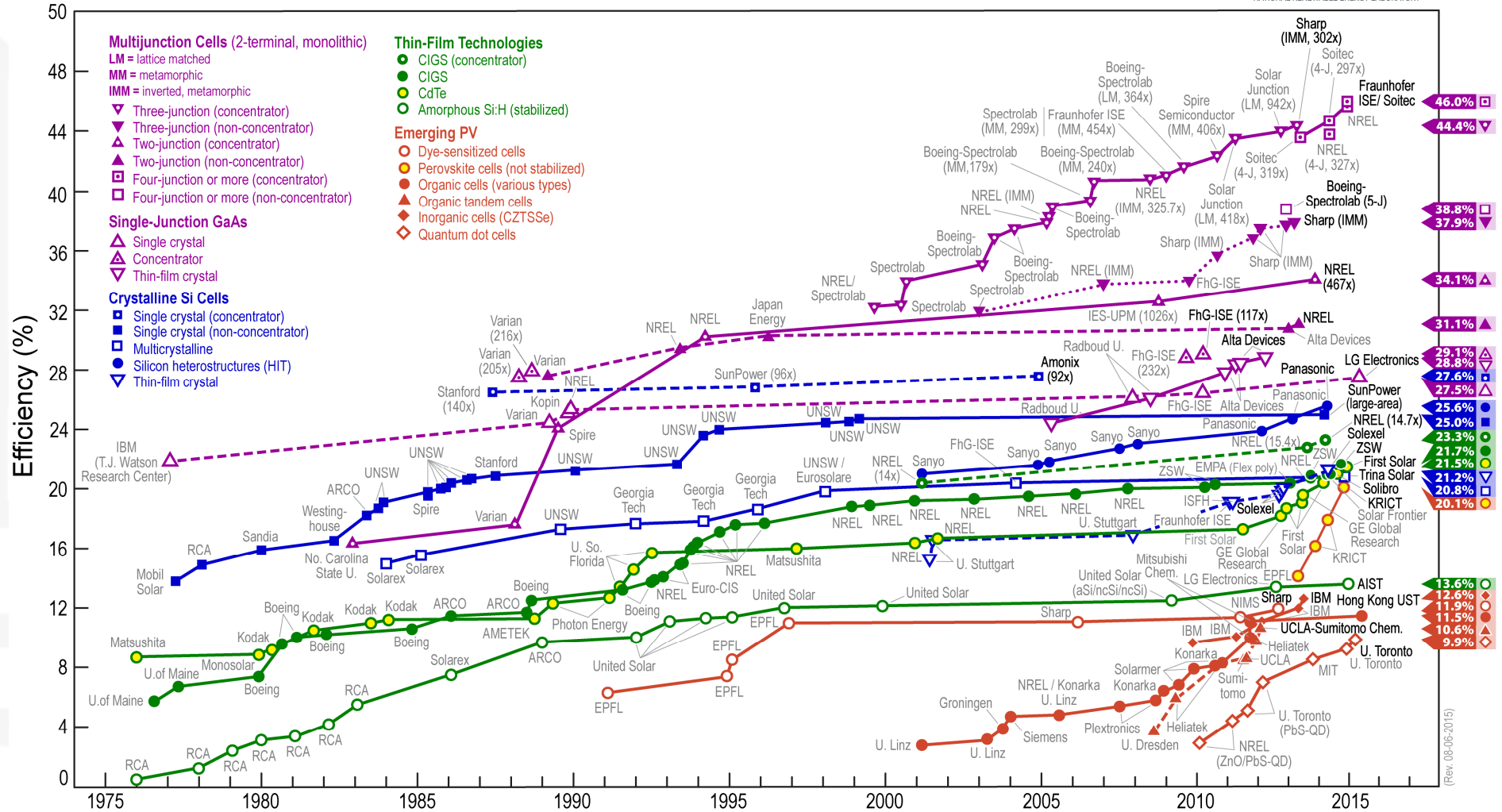
Dario Pasini

7/10/2015



Sistemi Fotovoltaici: NREL Chart

Best Research-Cell Efficiencies

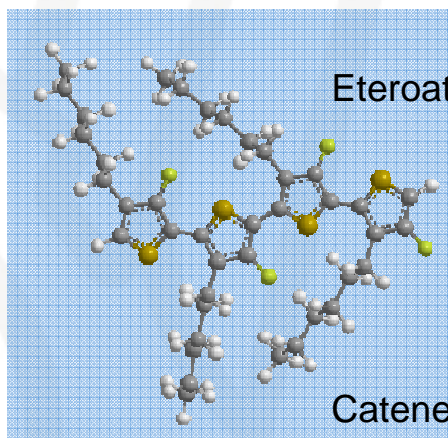
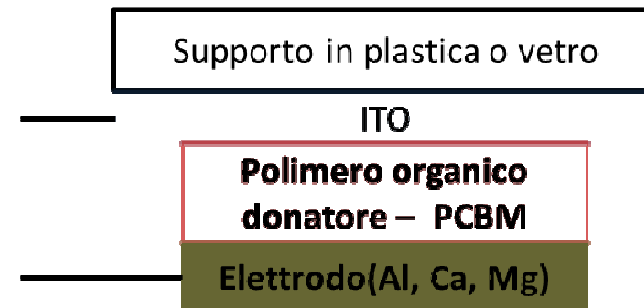


Fotovoltaico Organico Polimerico

Le celle fotovoltaiche convertono radiazione luminosa in elettricità tramite effetto fotovoltaico



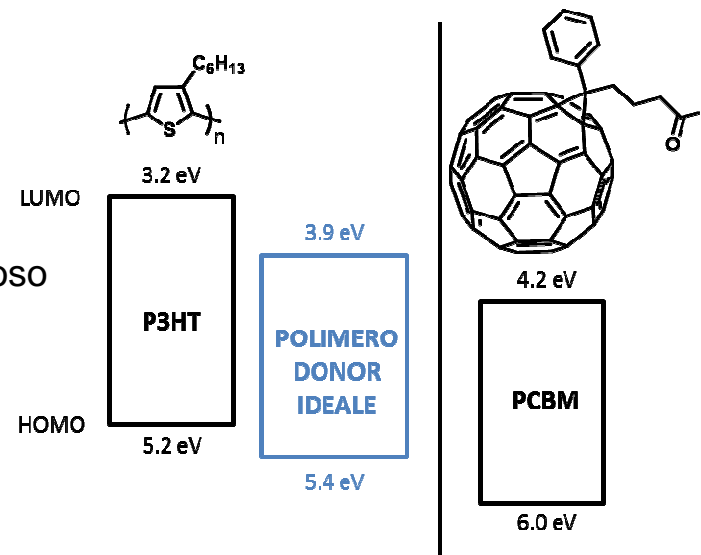
Devices più studiati (OPV):
architettura Bulk-Heterojunction (BHJ)



Eteroatomi

Scheletro carbonioso π -coniugato

Catene alifatiche per solubilità



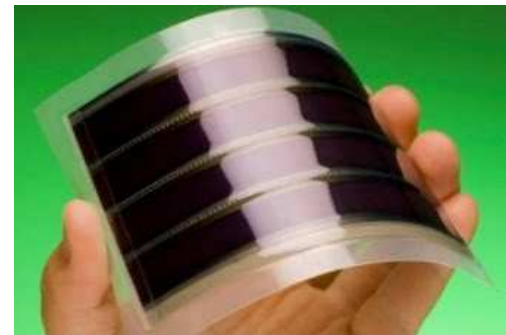
Vantaggi e Svantaggi OPV vs Si

Svantaggi:

- ***Efficienze più basse***
- ***Ridotta stabilità temporale***

Vantaggi:

- ***Costi inferiori per la produzione del materiale attivo (polimero vs cristallo di silicio)***
- ***Flessibilità meccanica***



Grado di Maturità della Tecnologia

- **Infinity OPV: recente startup (Technical University of Denmark). Una delle tre industrie a livello mondiale che vende celle OPV**
- **Prodotto garantito due anni. Efficienze tra il 2 e il 4%**



The screenshot shows a web browser window displaying the website www.infinitypv.com/infinitypro/opv/foil. The page features the InfinityPV logo and navigation links for Standalone, infinityPro, and social media icons. The main content area is titled "infinityPV foil" and includes a detailed description of the product, two images of the foil, a video player showing a person cutting the foil, and a section for specifications and prices. A sidebar on the right contains an "Order infinityPV foil" section with payment instructions.

Comparison of additive... x PV infinityPV foil x Emerging Technologies C x

www.infinitypv.com/infinitypro/opv/foil

infinityPV foil

infinityPro • OPV • Demonstrator • infinityPV foil • Custom

infinityPV foil is infinitely printed organic solar cell (OPV) by the meter. We can produce the modules at any length tailored to any need. The solar foil is produced on thin plastic foil with a high degree of flexibility that allows unique applications and integration possibilities. The infinityPV foil can be cut to fit your application or used in a serial connection as delivered. Additional electronics might be required to suit the voltage range of your application.

Order infinityPV foil
Please submit a [quotation request](#) to pay by bank transfer, recommended for large orders and VAT free orders (requires VAT number). You can also request to pay with Paypal if you wish to pay with a credit card.

The following video explains how to cut and contact the infinityPV foil at home (DIY)

infinityPV foil - printed organic sol...

infinityPV foil specifications and prices
IMPORTANT WARNING These solar cells build up potentially lethal voltage for lengths above 10 cm. You need to download, sign, and send us the [customer awareness declaration form](#) before we can ship this product to you.

Integrabilità in Tessuti

The Solar Textile Challenge: How It Will Not Work and Where It Might

Frederik C. Krebs* and Markus Hösel^[a]

Solar textiles are highlighted as a future technology with transformative power within the fields of both textiles and solar cells provided that developments are made in critical areas. Specifically, these are fundamental solutions to materials and material combinations with mechanical stability and flexibility imposed by textile architectures, scientific solutions to achieve high carrier transport efficiency and optical transmission in a textile topology, technical solutions to controlling the physi-

cal disposition of the anode and cathode along with their specific and error-free contacting and, finally, practical solutions to fast and efficient manufacture and integration. The areas of application and the penetration of solar textiles into our everyday life are expected to be explosive pending efficient developments within these four key areas. A shortcoming in one or more of these will, however, lead to the solar textiles being banned to academic existence.

[a] Dept. of Energy, Solar Energy Section, Technical University of Denmark

Integrabilità in Tessuti

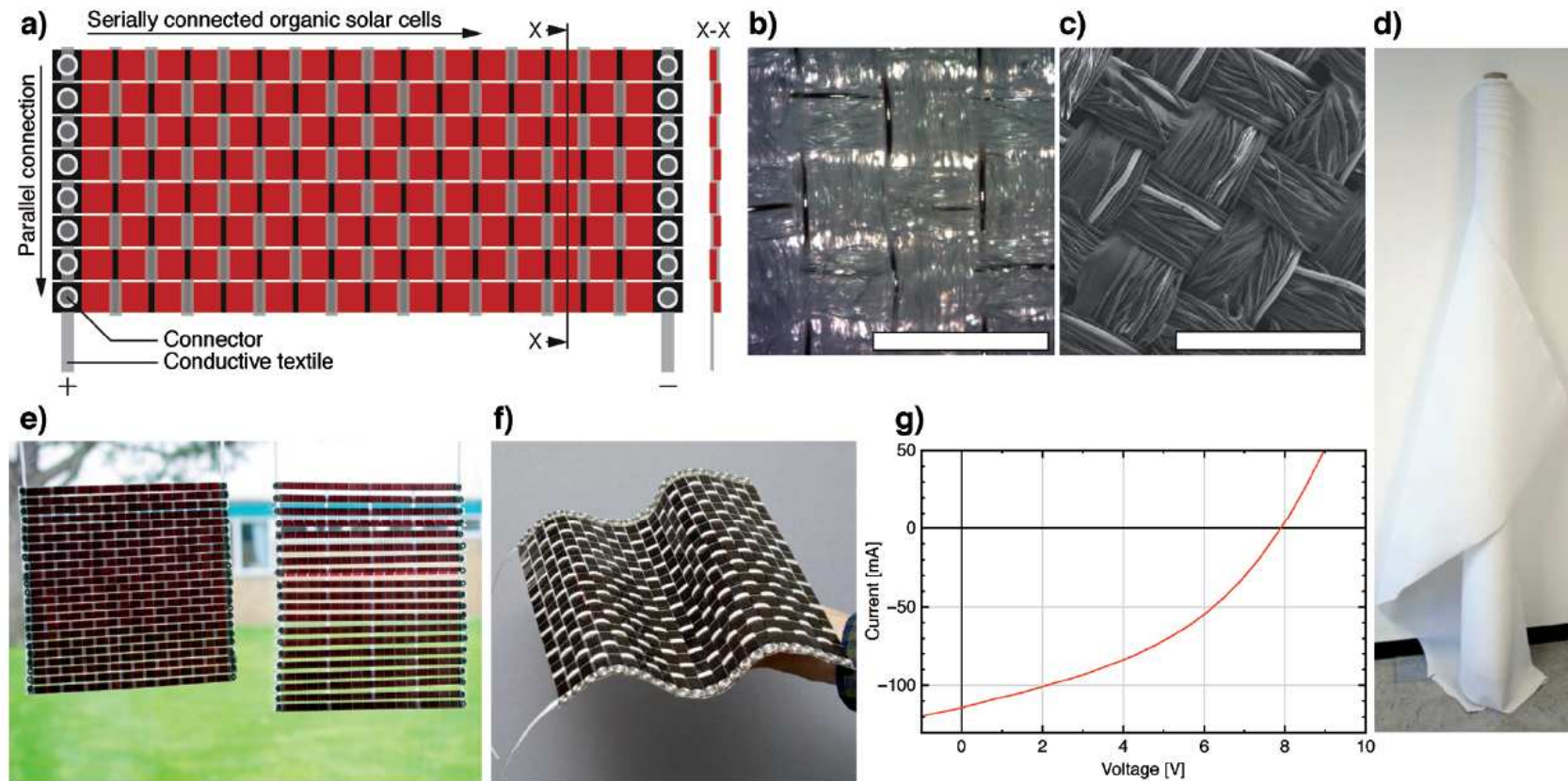


Figure 2. An illustration of a **tape-weaved solar cell textile** that efficiently takes advantage of the inherent directionality of the textile approach such that the positive and negative electrode are separated. Shown here schematically as a) solar cell tape as weft and conducting woven polyester material as warp, shown as an optical micrograph in (b) and as a scanning electron micrograph in (c) [scale bar in (b) and (c) corresponds to 10 mm], with a roll of woven polyester fabric with embedded silver wires shown in (d). The warp is used as electrical bus bar at the edges of the textile along the web direction for large-area (25 × 25 cm²) examples shown in (e) and (f). An *I*-*V* curve is shown in (g) with the solar cell comprising tapes of indium-tin-oxide-free polymer solar cells prepared entirely by R2R processing.^[1] The solar tapes have 16 serially connected single junctions and an active area of 368 cm², a **power conversion efficiency of ~1%**, open circuit voltage (V_{oc}) = 7.9 V, short circuit current (I_{sc}) = 114 mA, and a fill factor (FF) = 40%.

I Materiali

Architettura dello strato fotoattivo:

- **Bulk Heterojunction (BHJ): miscela bicontinua sulla nanoscala**



Parametri importanti



Domini cristallini bicontinui di 10-20 nm: organizzazione sulla scala nanometrica

Self-assembly e stabilità

Fattori che influenzano la morfologia finale:

- Natura dei componenti D ed A
- Miscibilità intrinseca tra D ed A
- Solvente usato e condizioni di *solvent annealing*
- Peso molecolare medio e regioregolarità dei polimeri
- Natura e lunghezza delle catene laterali solubilizzanti

Approccio iniziale UNIPV

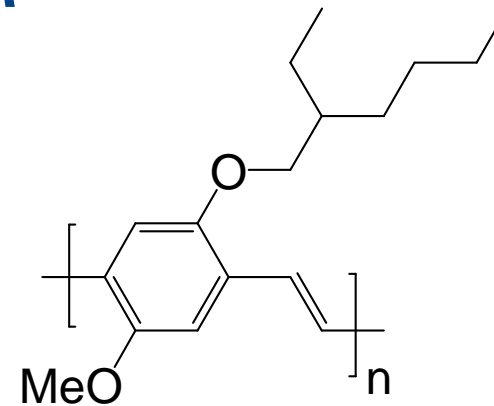
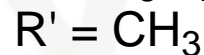
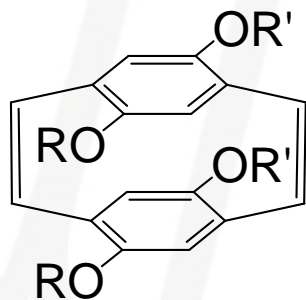
Polimeri coniugati tramite polimerizzazioni controllate

Vantaggi:

a) controllo polidispersità;

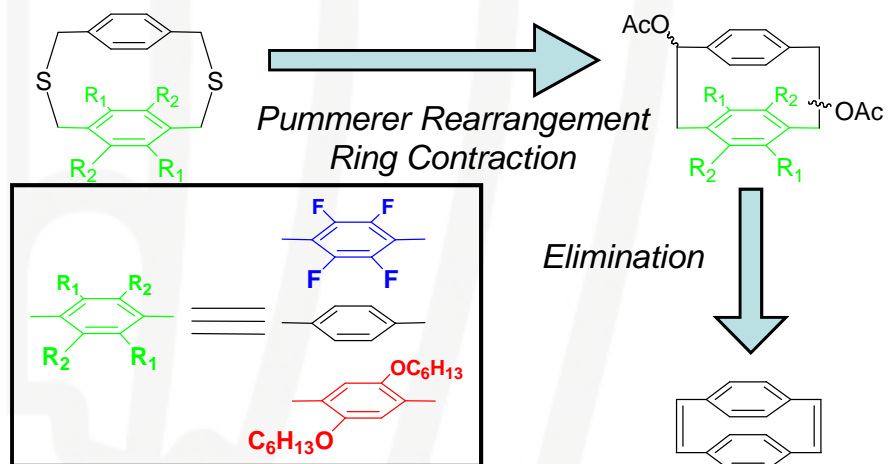
b) controllo funzionalità endcapping;

c) Possibilità di reiniziare polimerizzazione: copolimeri a blocchi, controllo MORFOLOGIA



MEH-PPV

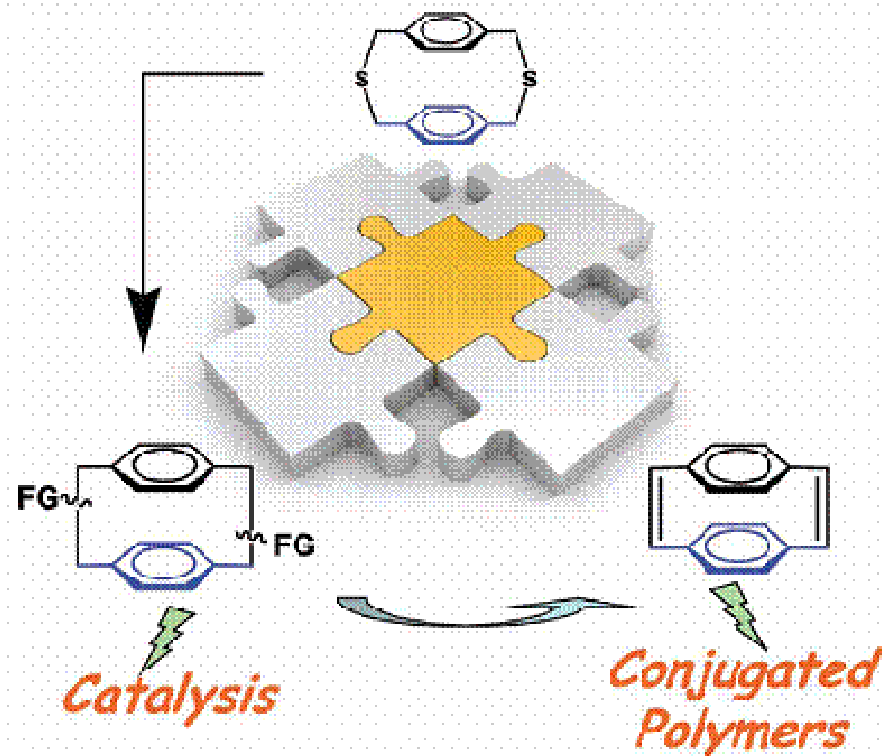
Sintesi Monomeri Innovativa



Organic & Biomolecular Chemistry

www.rsc.org/obc

Volume 9 | Number 14 | 21 July 2011 | Pages 5018-5020

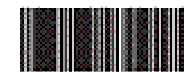


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RSC Publishing

COMMUNICATION
 Montanari et al.
 In situ preparation of functionalized [2,2]paracyclophanes via the Pummerer rearrangement

International Year of
CHEMISTRY
 2011

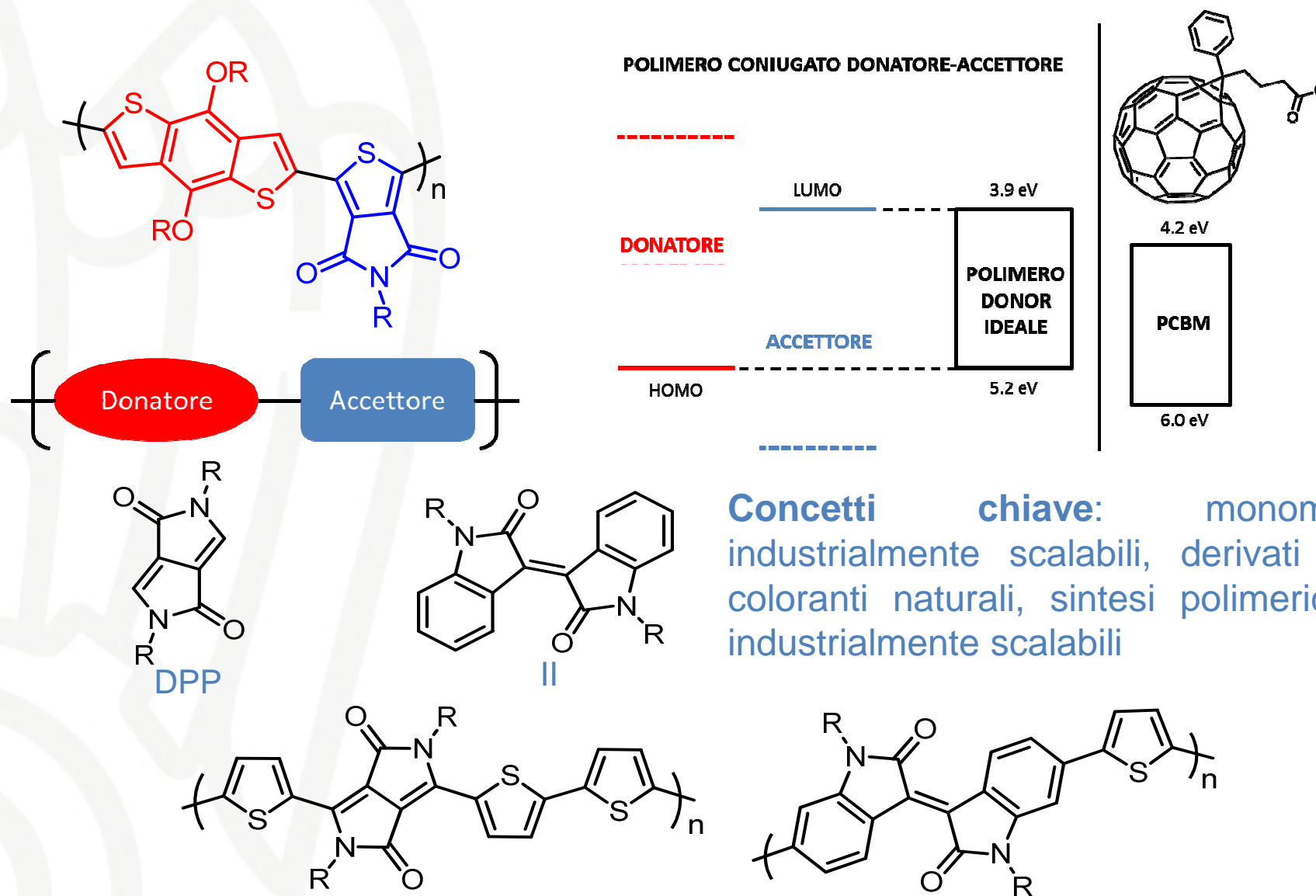


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Collaborazione con ENI

- ***Centro di ricerca ENI Donegani (Novara)
Research Center for Renewable Energies &
Environment (Riccardo Po')***
- ***Finanziamento di una borsa di Dottorato + materiale
di laboratorio (70.000 Euro) in corso***
- ***Ricerca comune con accordi precisi a tutela della
proprietà intellettuale ENI***

Conjugated Donor-Acceptor Polymers

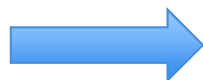


Principali metodi di Polimerizzazione

Sintesi Monomeri richiede reagenti poco scalabili industrialmente (organometallici)

Sottoprodotti stechiometrici di reazione non ecofriendly (sali di stagno o boronati)

Suzuki coupling



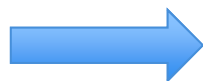
Suzuki coupling



Stille coupling



Stille coupling

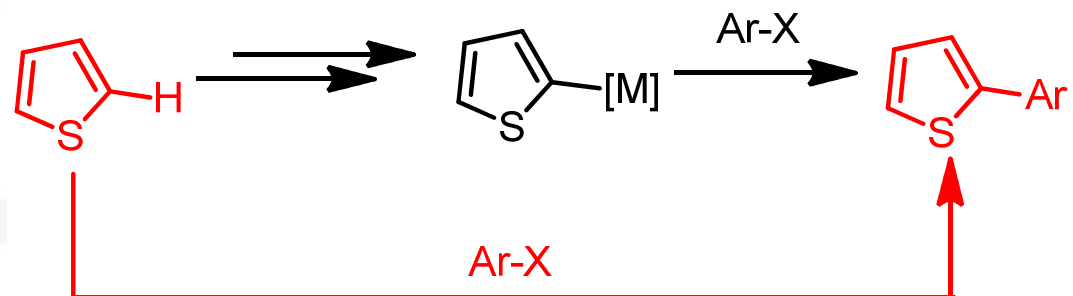


Stille coupling



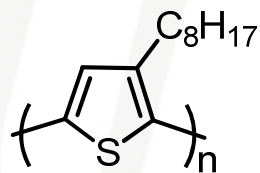
	Electronic properties	Number of synthetic steps
	Acceptor	3
	Acceptor	3
	Donor	4
	Acceptor	4
	Acceptor	5
	Donor	5
	Donor	5
	Donor	6
	Acceptor	7
	Donor	7

Direct Hetero Arylation Polymerization

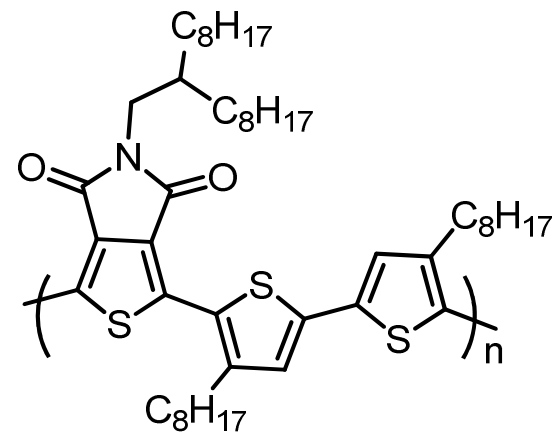


Direct Arylation

Concept: Catalitica, economica, eco friendly, scalabile industrialmente



M_n 30.6 KDa, PDI 1.6
rr 98%



M_n 56 KDa, PDI 2.6



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