

**B**ench-to-Scale-n-Flow: integrated process development for the synthesis of key-main group-embedded organic semiconductors



Manuel Morillas- Ana B. Cuenca

Successful R & I in Europe 2024, 16th February, Dusseldorf

# The team



**Who we are:** Widely respected **academic research team** (14 people) working in **Innovative Chemical Methodology** - Barcelona – Spain (**chemists**).

**What is our competitive EDGE:** Experts in **main-group chemistry** (boron, organic silicon, iodine...) and **catalysis**. **One of the few groups** with expertise in the preparation of a particular type of **organic semiconductors** (BN-doped polyaromatic hydrocarbons).

**Facilities:** **State-of-art synthetic lab.** set-up (**batch mode and continuous flow** –including scale-up (kg)) with a very complete characterization supportive platforms.

TITAN Continuous Flow reactor (250 mL/min)

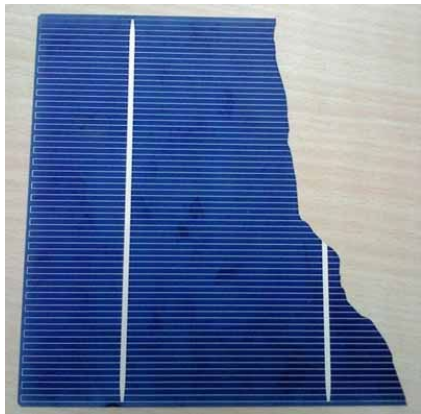




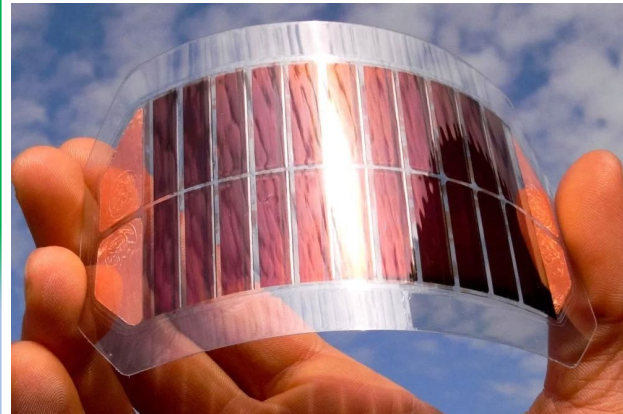
# Next-generation materials (**organic electronics**)!

Change of paradigm in semiconductor materials

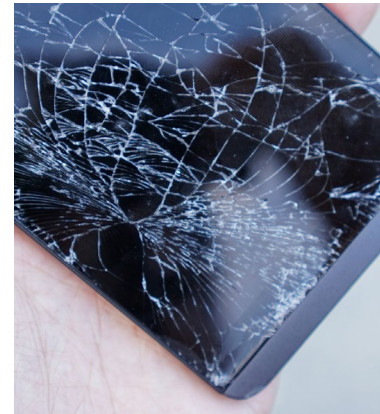
breakable standard silicon solar cell



flexible materials



unbreakable touchable screens



energy saving lamps and natural colours OLEDs



## High-cost production

(lattice-materials):  
need of high purity  
elemental crystalline

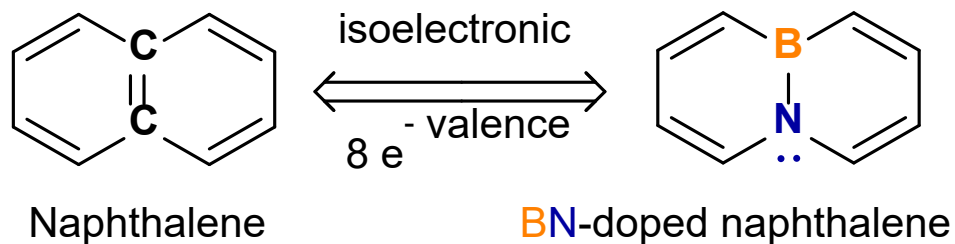


## Low-cost production

- intrinsic behavior: more tolerance to impurities
- high synthetic modularity
- easier to deposit and potentially printable !

# Topics of interest

Concept

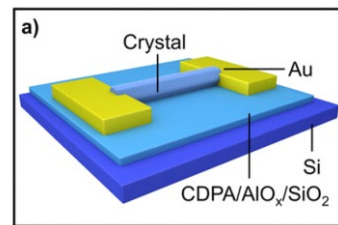


- 2 years development: **now 2 weeks (multigram scale) !**
- **promising optoelectronic properties**
- **high electron mobilities and low reorganization energies**

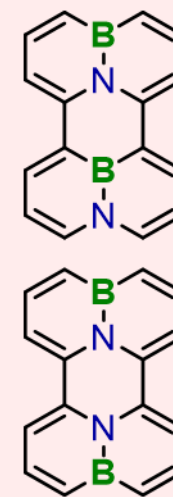
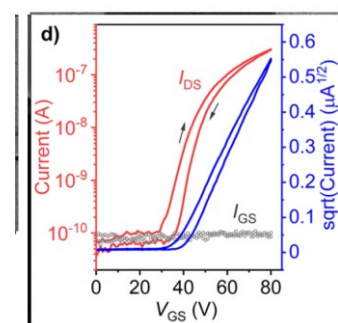
Next-generation materials (**organic electronics**) !

## This work solutions:

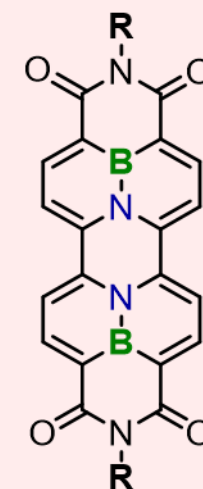
- Optimized BN-building blocks
- High scale preparation
- Flow implemented production
- Seamless supply of BN components for chips and semiconductors devices



with permission of ACS



Wang & Pei, 2021  
First **BN-embeddeed**  
**perylene 3**



4, R=EH

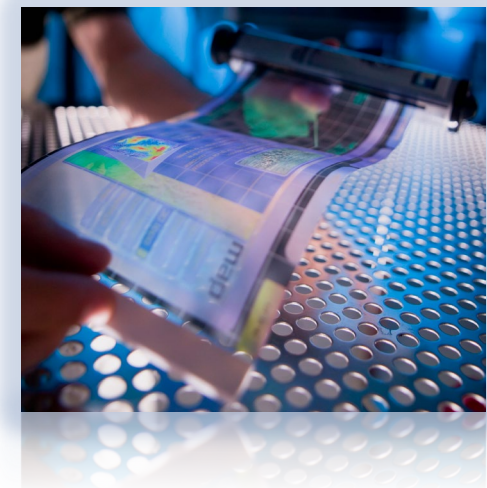
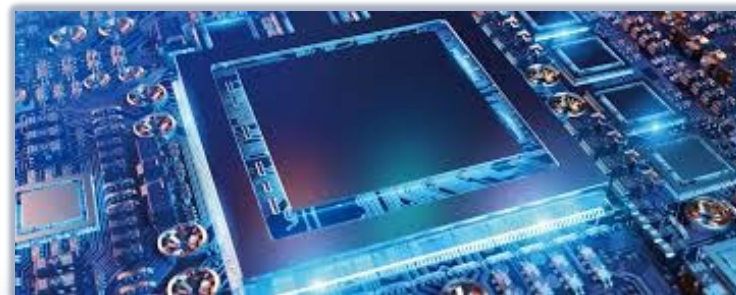
Wang & Pei, 2023  
First **BN-embeddeed**  
**PDI**s and **OFET**s  
**devices**





**Type of EU projects:** our **target** would be joint call oriented to explore new organic semiconductors

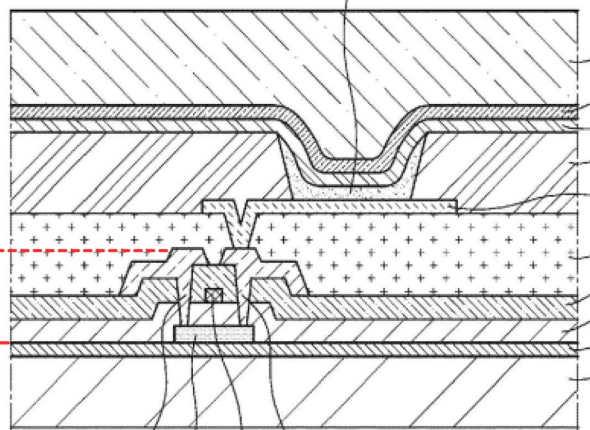
**Seeking for:** companies, research institutes or universities that **works on the fabrication of chips or optoelectronic devices**, or **any consortium that requires the incorporation of a chemical team with molecular vision and innovative synthetic capacity**



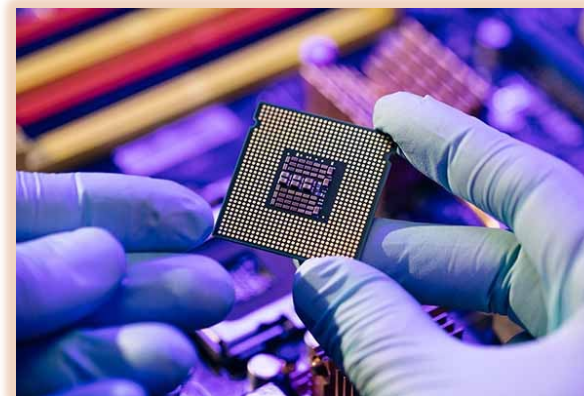
# Expected consortium

**Partner 1:** fabrication of non-organic components

Thin film transistor



- sealing unit
- capping layer
- second electrode
- pixel defining film
- first electrode
- passivation layer
- insulating film
- gate insulating film
- buffer layer (protection)
- substrate



source electrode

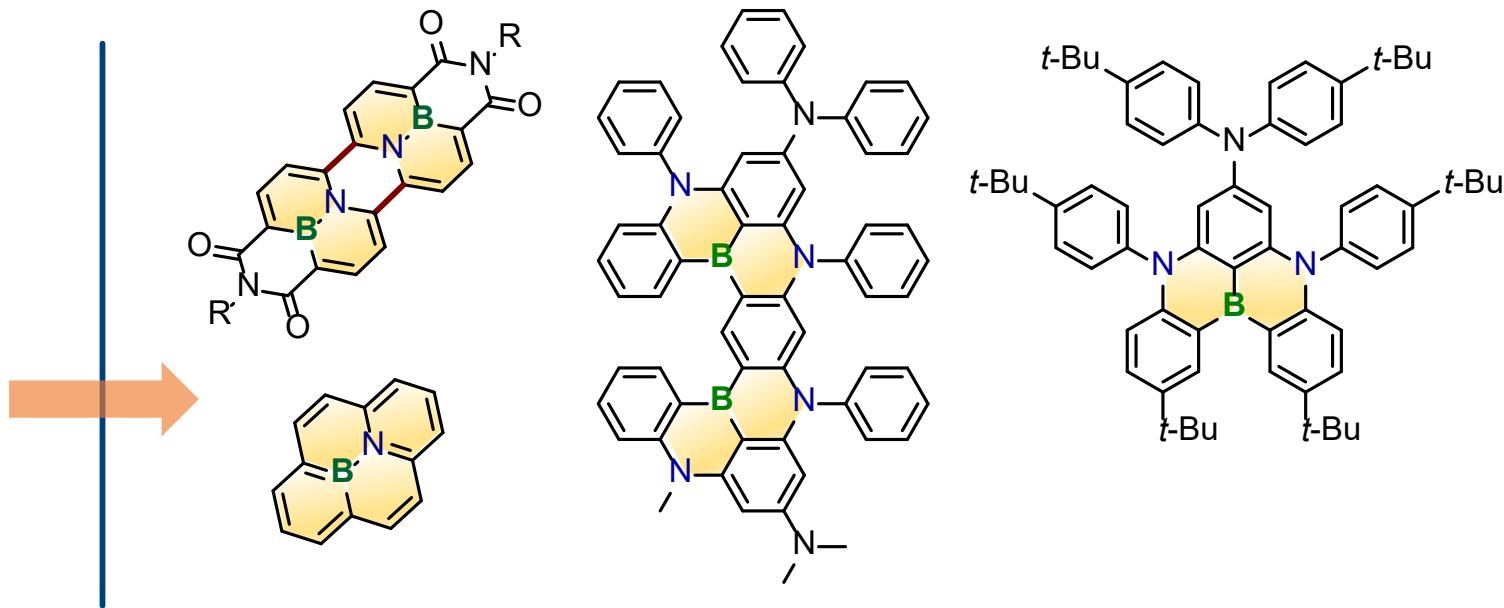
drain

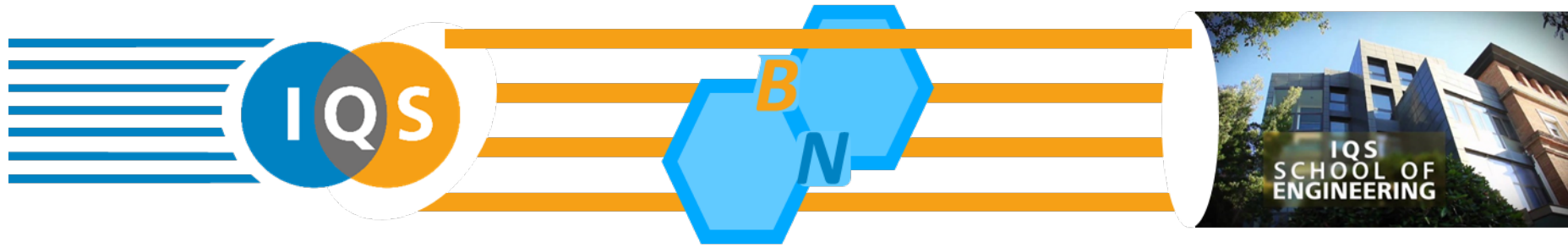
gate electrode  
**Active layer**

**Partner 2:** manufacture chips or optoelectronic devices

Active **BN** components used in the **Active Layer**

**We (IQS):** B-N containing PAHs organic active layer components





## Contact info:

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CHEMICAL REACTIONS FOR INNOVATIVE SOLUTIONS (CRISOL RESEARCH TEAM)

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