

Rapid and high resolution patterning in organic semiconductors

ORGANIC ELECTRONICS AND PHOTONICS

Contact

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*Structural and compositional modification in
molecular organic thin films for optoelectronic
and photonic devices*

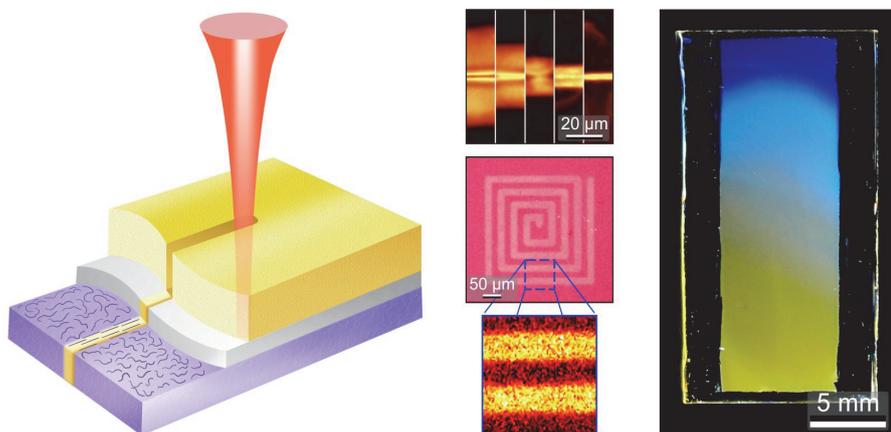
Why do we need to locally modify molecular organic thin films?

A key part of fabrication of organic semiconductor active layers involve spatial patterning of material characteristics to enable device-specific functionalities

What is a 'molecular gate' and how does the method work?

Our method consists on the deposition of a molecular gate interlayer onto the semiconductor layer, followed by a donor layer comprising functional small molecules.

Application of a stimulus activates diffusion of the functional molecules into the semiconductor layer through the molecular gate interlayer



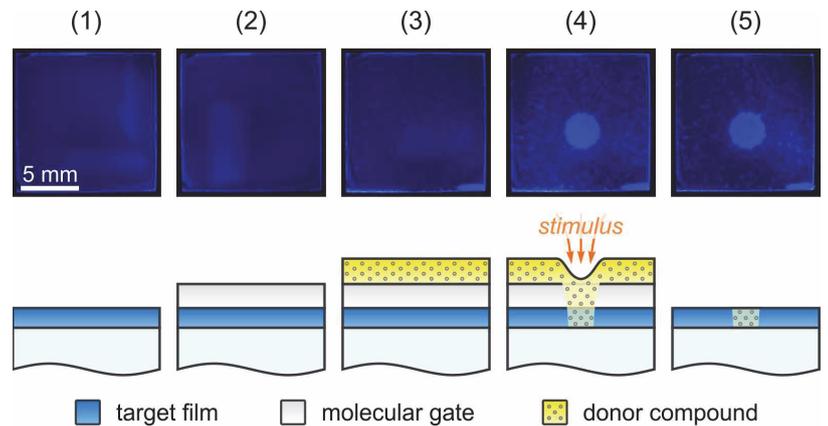
Schematic of the method (left) and examples of patterned structures (right)

We have developed a new a method for high resolution structural and/or compositional modification in a molecular organic semiconductor film. This method has applications in the production of electronic, optoelectronic and photonic devices, among others

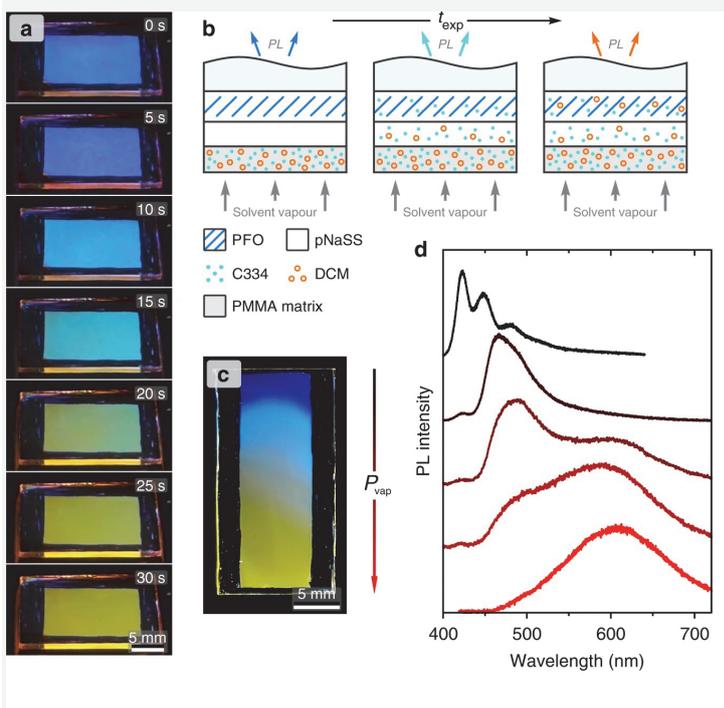
How can our micropatterning method improve the already existing methods?

The current methods (such as photolithography, laser induced forward transfer (LIFT), inkjet...) have some limitations in large areas roll-to-roll processing and several structural features remain unattainable within one step.

The new method enables the simultaneous patterning of material characteristics and concomitant final properties, including molecular conformation, orientation, crystallinity and composition.



Sequential processing steps of molecular-gate-based patterning and exemplary fluorescence images for a light-emitting polymer film



Advantages of the new micropatterning method

- ✓ For the first time, local patterning of molecular orientation achieved
- ✓ Compatible with high throughput fabrication methods
- ✓ No multisteps for multipatterning needed
- ✓ Roll-to-roll and scalable processing of printing methods, and high resolution of light-based methods
- ✓ One step patterning of composition in binary and ternary systems

Patent Status

European patent application filed suitable of international extension

Institute of Materials Science of Barcelona (ICMAB-CSIC)

Reference Article

Rapid and high-resolution patterning of microstructure and composition in organic semiconductors using ‘molecular gates’

Aleksandr Perevedentsev and Mariano Campoy-Quiles

Nature Communications, 11, 3610, 2020

[DOI: 10.1038/s41467-020-17361-8](https://doi.org/10.1038/s41467-020-17361-8)

Video “Schematic illustration of molecular gate concept”

https://youtu.be/YD_RDybSdo8



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