

Solvent Vapor Annealing of Organic Semiconductor Thin Films



From a custom-built processing device to morphology control in PFO and D18:Y6 films

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1. Introduction

The microstructure of organic thin films controls the performance of organic electronic and photovoltaic devices. Post-deposition processing lets us tune that microstructure to the target application.

OLEDs

OFETs

Organic solar cells

2. The SVA processing device

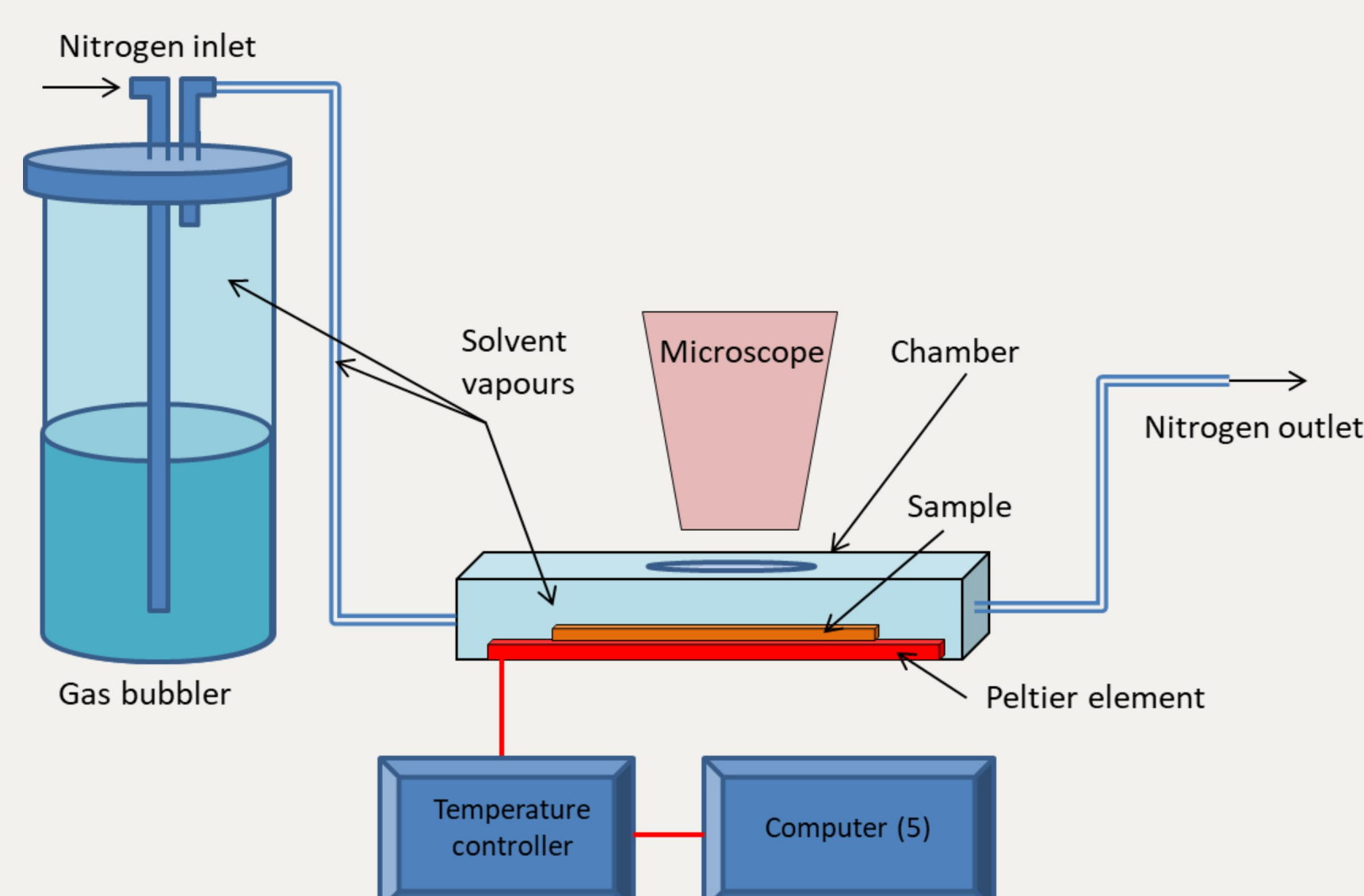


Figure 1. Schematic of the thin film processing device built at ICIA.

- Spin-coated films sit in an aluminum chamber held by a Peltier element with **0.01 °C** accuracy.
- Solvent vapor, carried by nitrogen through a bubbler, condenses on the cooled film and lets molecules reorganize into ordered conformations.
- Heating then evaporates the solvent, fixing the ordered structure; a window allows in-situ microscopy.

3. Validation on PFO films

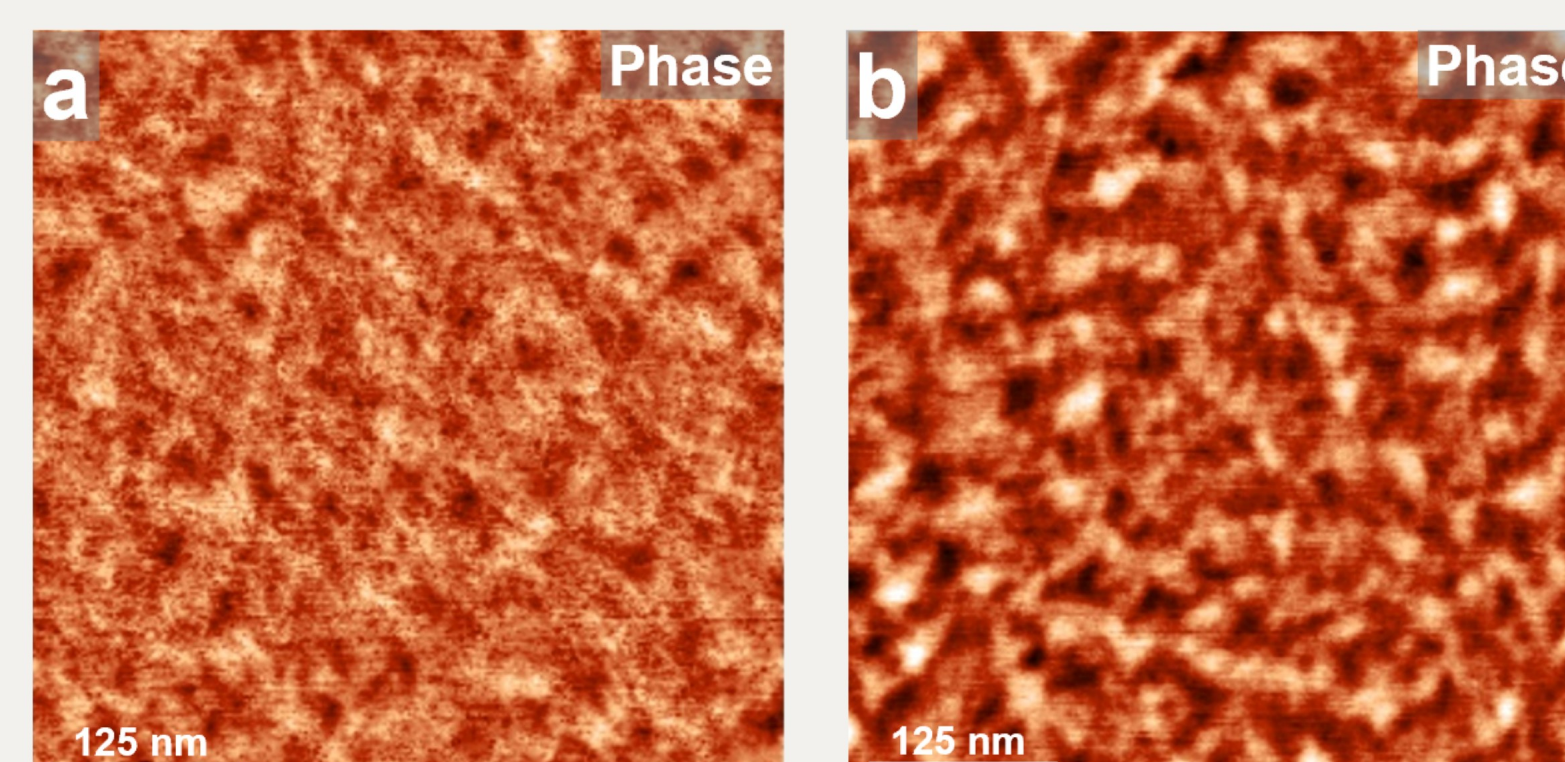
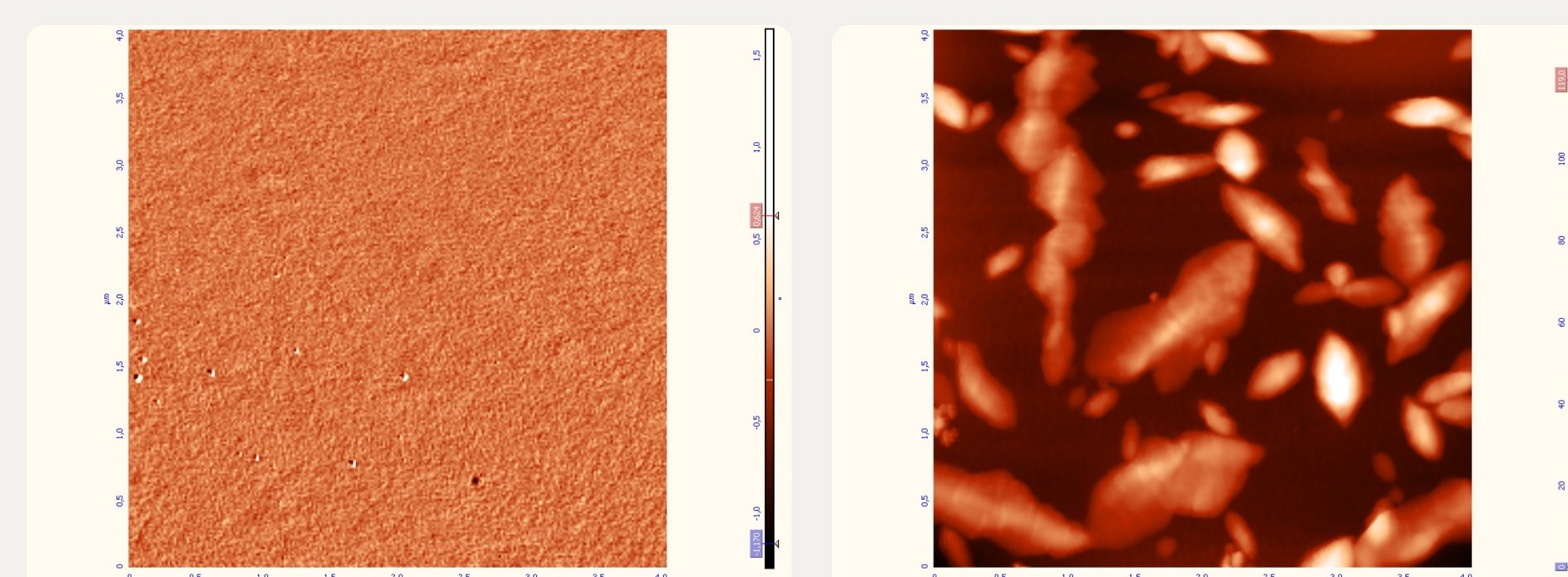


Figure 2. AFM phase images of a PFO film before (a) and after (b) processing.

- The processed film shows larger, more compact and more ordered crystalline domains.
- Absorption and emission spectra confirm a large enhancement of photoluminescence [2].

4. Chlorobenzene SVA of D18:Y6 films

Spin-coated D18:Y6 blend films were exposed to chlorobenzene vapor; morphology was followed by AFM ($4\ \mu\text{m} \times 4\ \mu\text{m}$) and excitonic behavior by PL.



(a) As-cast

Homogeneous morphology, low phase contrast

(b) After SVA

Larger, laterally extended domains, much higher phase contrast

5. From morphology to photoluminescence

Larger domains
after chlorobenzene
SVA



**Smaller D-A
interface**
lower effective
interfacial area



**Reduced PL
quenching**
fewer excitons
dissociate

Photovoltaics: less favorable
Charge generation needs a large D-A
interface

Emissive devices: promising
Reduced quenching favors light emission

6. Conclusions

- ✓ A custom SVA device with 0.01 °C control was built and validated at ICIA.
- ✓ PFO: more ordered crystalline domains and strongly enhanced PL.
- ✓ D18:Y6: larger domains, smaller D-A interfacial area, reduced PL quenching.
- ✓ **SVA tailors films to the application: less suited to photovoltaics, promising for emissive devices.**

References

1. O. Todor-Boer, B.-I. Ștefan, L. Máthé, C. Văcăriceanu, I. Botiz, Thin Solid Films 839 (2026) 140907.
2. O. Todor-Boer, C. Farcau, I. Botiz, Polymers 16 (2024) 2278.

