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# Synthesis of novel semiconductor polymer based on Azo-anthracene for flexible organic electronics

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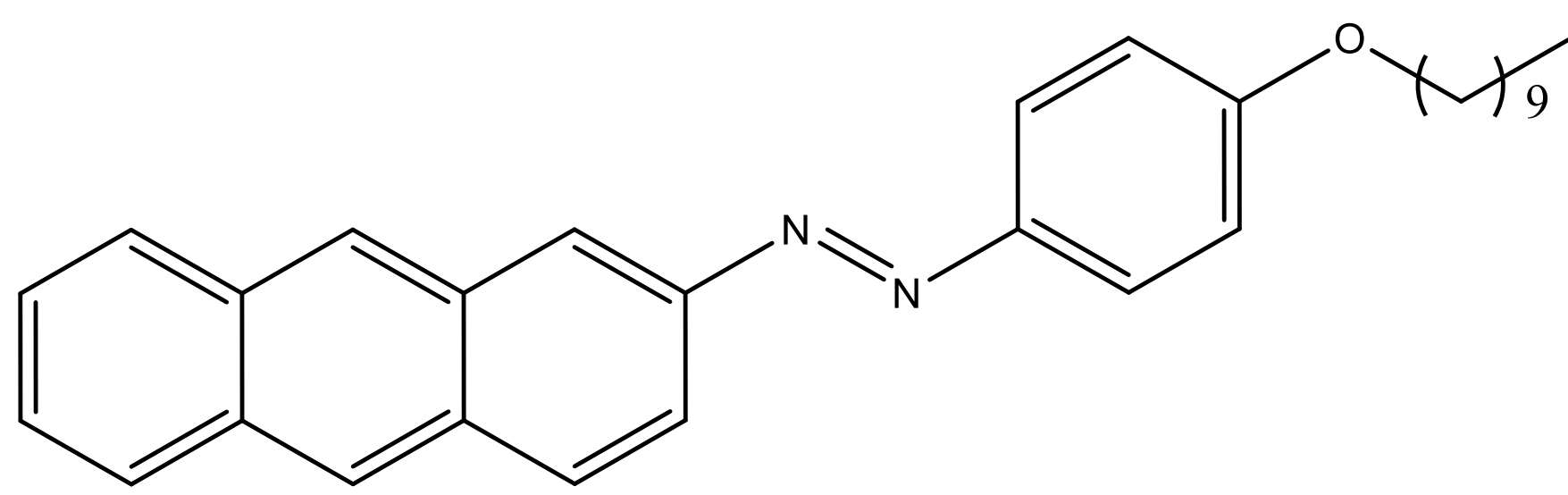
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## ABSTRACT

This study focuses on the synthesis and characterization of a new semiconducting polymer based on anthracene to use in flexible organic electronic devices. The polymer was obtained by in situ-photo-thermal polymerization process from a firstly synthesized epoxy functional monomer. Thermo-physical properties and phase behaviors of poly 10-OPDA were investigated by polarized optical microscopy (POM) and differential scanning calorimetry (DSC). Chemical structure was determined by nuclear magnetic resonance spectroscopy. Finally, this novel material will be used in order to investigate its potential applications for organic field effect transistor (OFETs), organic photovoltaics (OPVs), as well as for thermoelectric conversion devices.

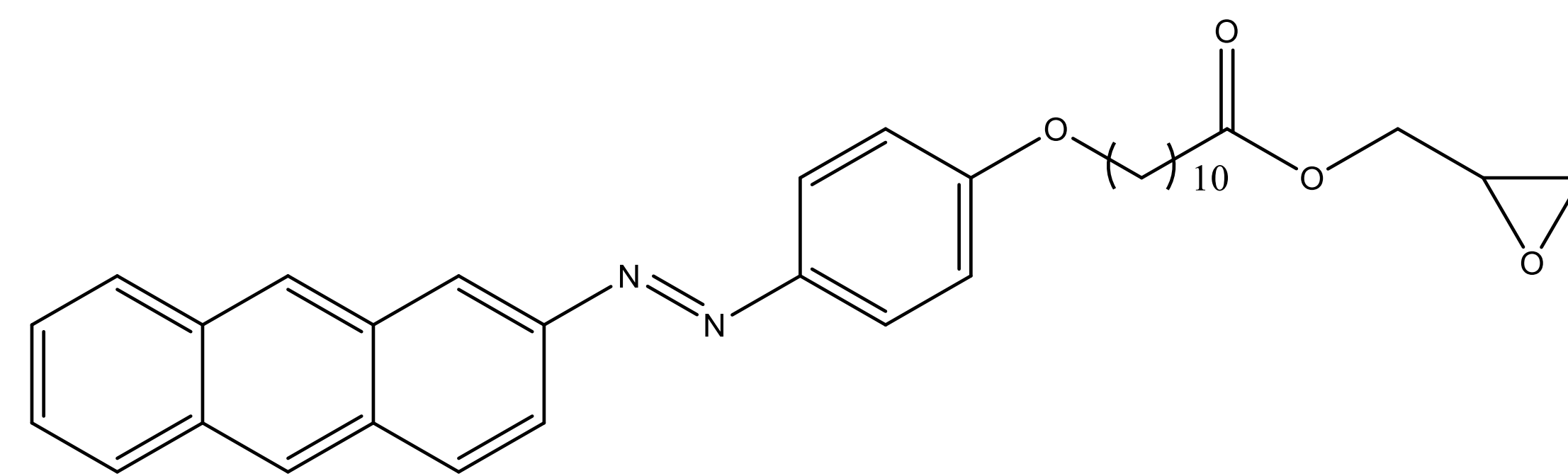
## CHEMICAL SYNTHESIS

### 10-OPDA



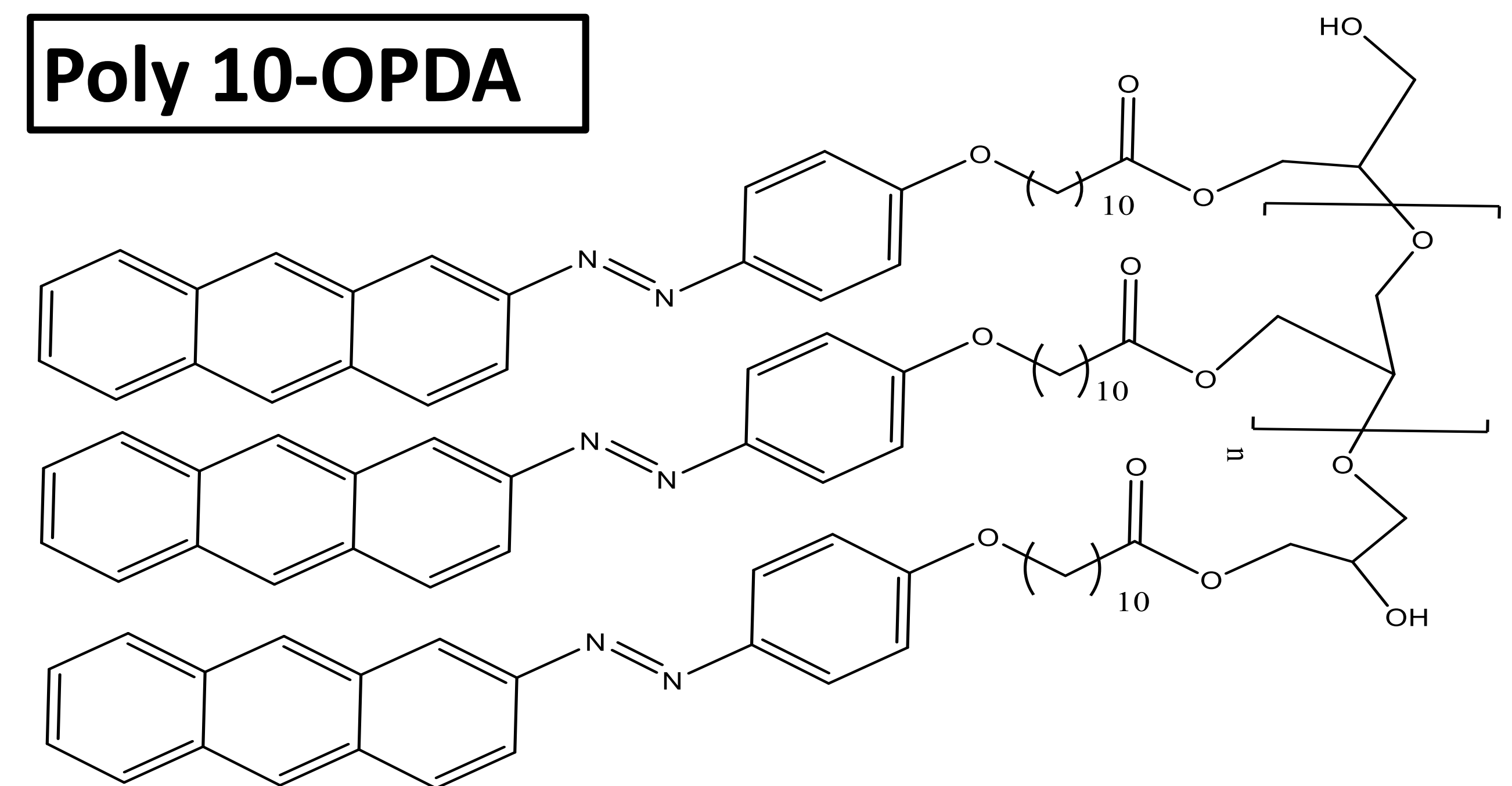
10-OPDA was synthesized in three steps diazotization, azo-coupling and alkylation. It was characterized by <sup>1</sup>H NMR

### Functionalized 10-OPDA



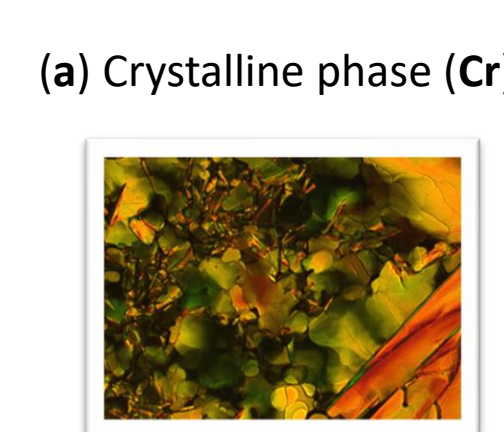
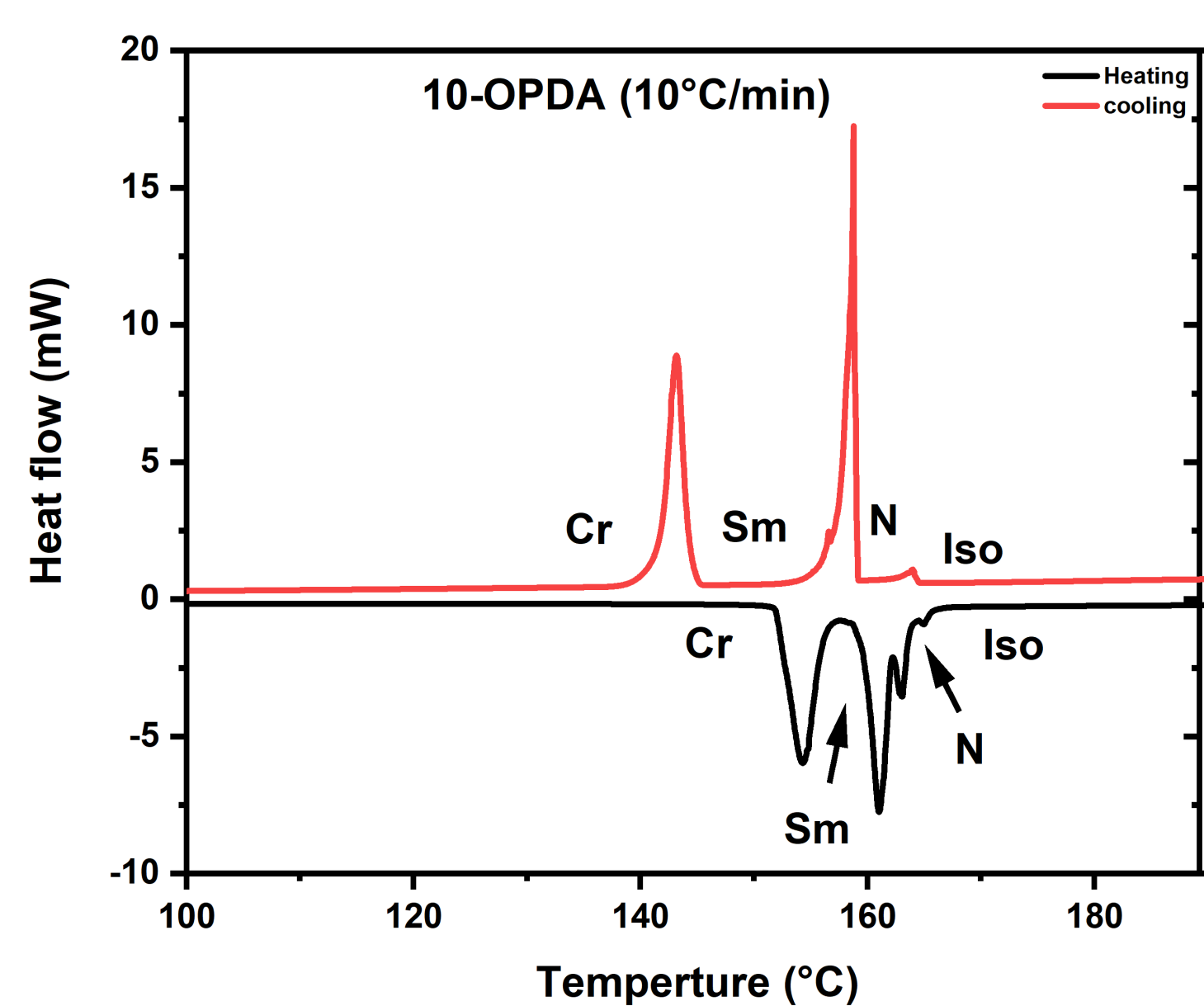
Functionalized 10-OPDA (monomer) was synthesized in five steps diazotization, azo-coupling, alkylation, saponification and esterification with epichlorohydrin. It was characterized by <sup>1</sup>H NMR

### Poly 10-OPDA



Poly 10-OPDA (polymer) was synthesized by photo-thermal polymerization using NITF as photoacid generator under UV light (1 h at 254 nm, 0.025 mW/cm<sup>2</sup>) for the initiation step and heating (24 h at 180 °C) for the propagation and termination steps. It was characterized by <sup>1</sup>H NMR

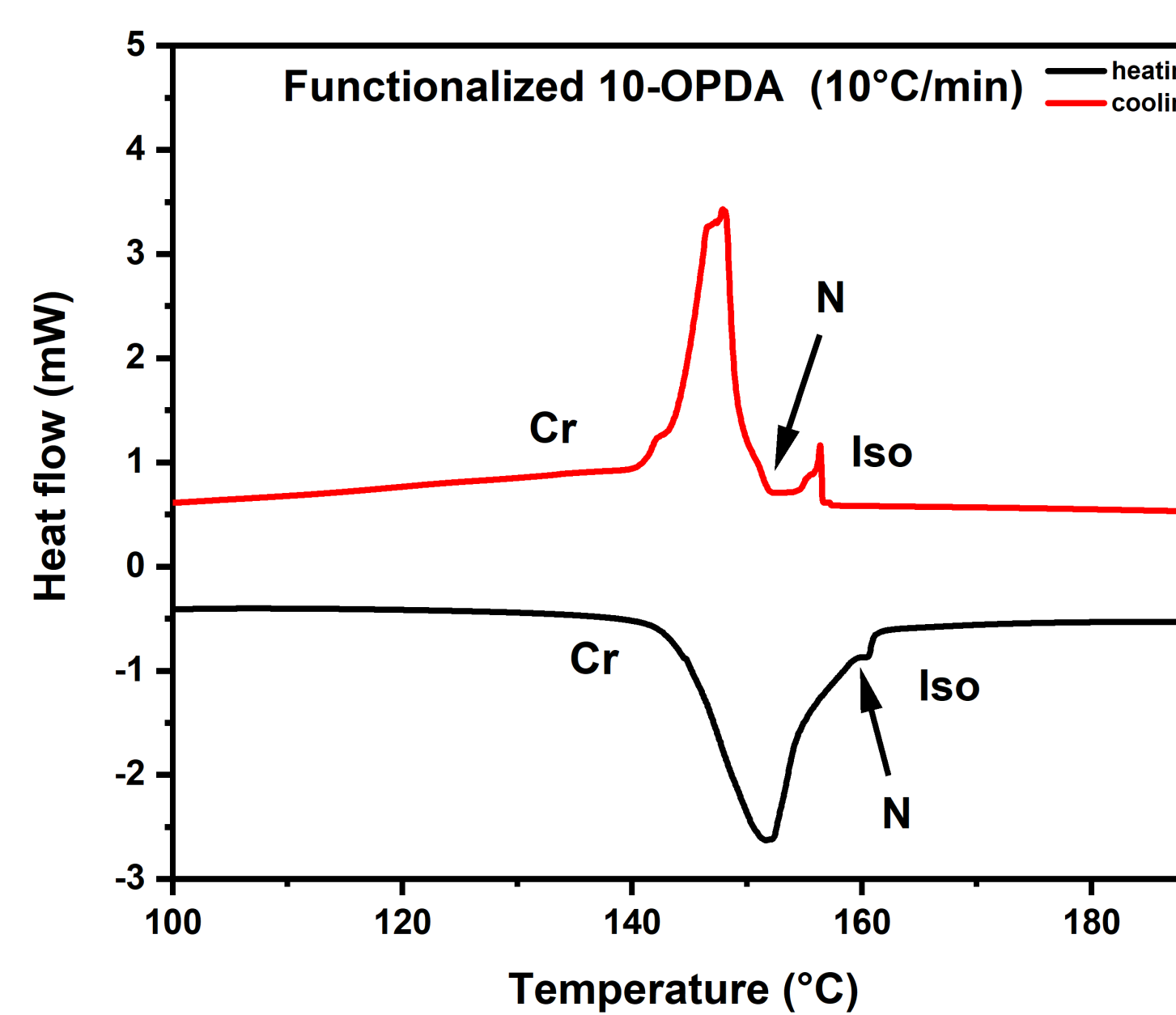
## PHASE BEHAVIOR



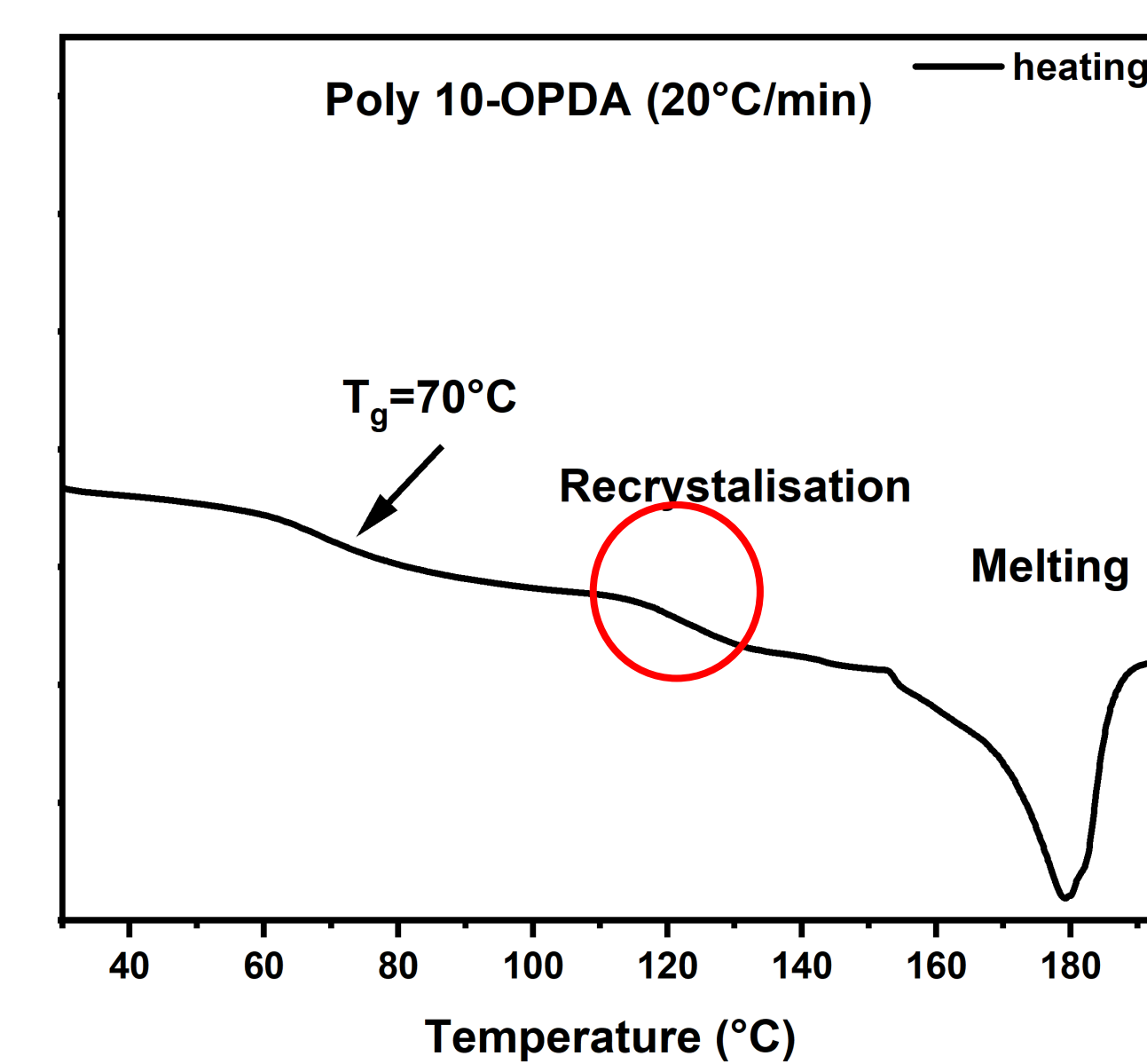
(c) nematic phase (N)

DSC thermograms of 10-OPA sample exhibits reversible mesomorphic behavior, evidenced by 3 phase transitions: Cr-Sm, Sm-N and N-Iso.

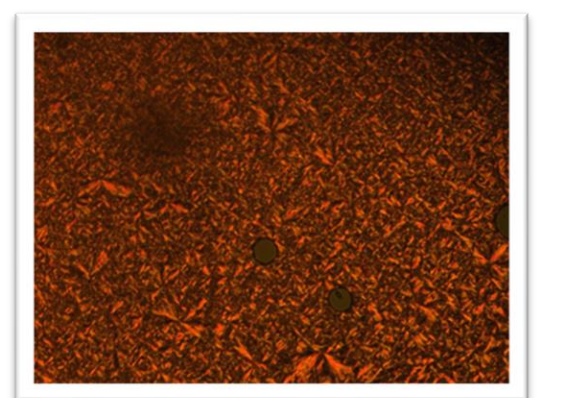
Textures observed by POM for 10-OPDA in cooling: (a)- Cr at 140°C, (b)- Sm at 163°C and (c)-N at 165°C.



DSC thermograms of 10-OPDA functionalized sample exhibits two phase transitions : Cr-N and N-Iso.



DSC thermograms of poly 10-OPDA sample exhibits on heating a glassy transition temperature (T<sub>g</sub>) at 70°C, hot recrystallization and melting.



(a) Crystalline phase (Cr)



(b) Isotropic phase

Textures observed by POM for poly 10-OPDA in cooling: (a)- Cr at 175°C and (b)- Iso at 180°C.

## CONCLUSION

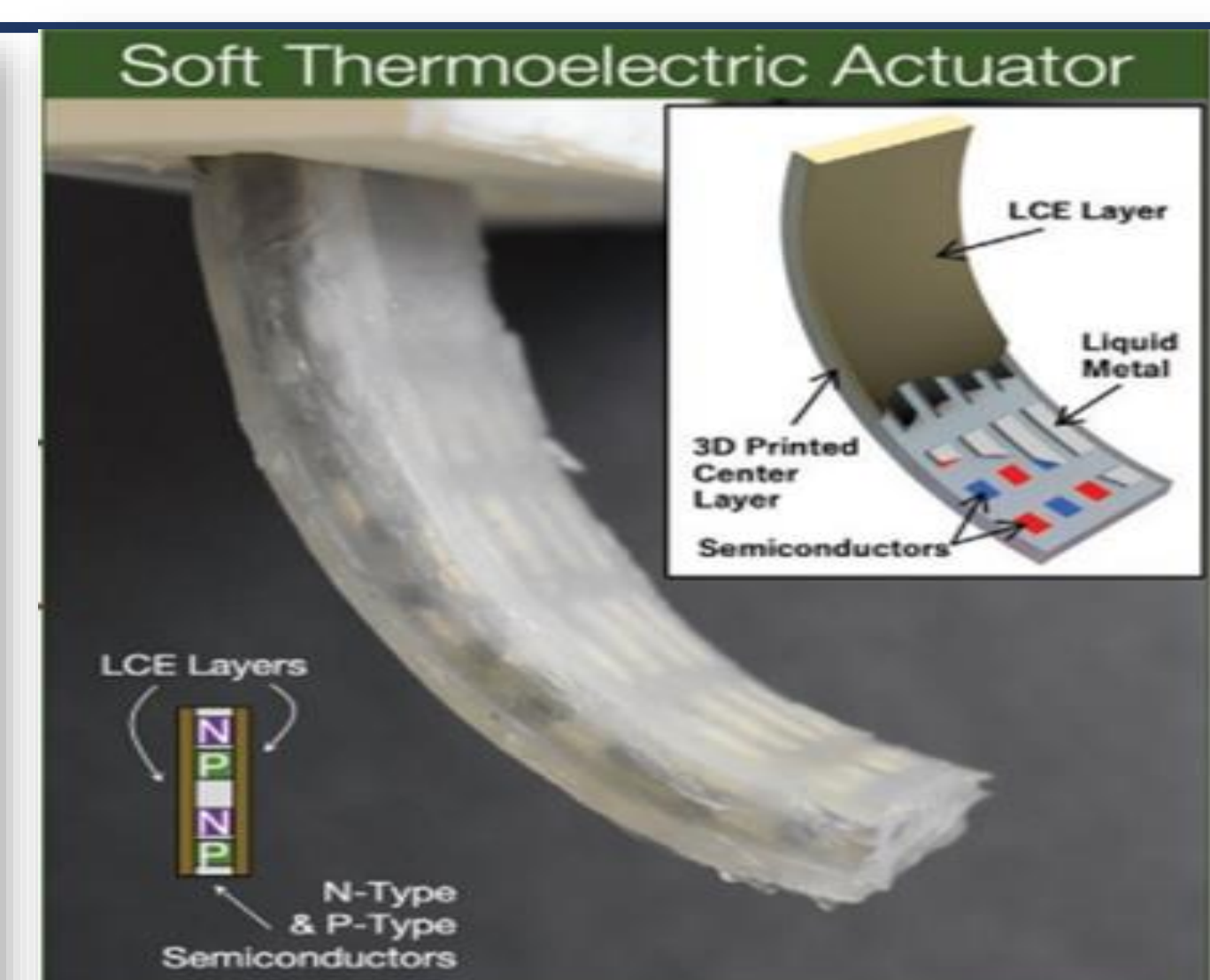
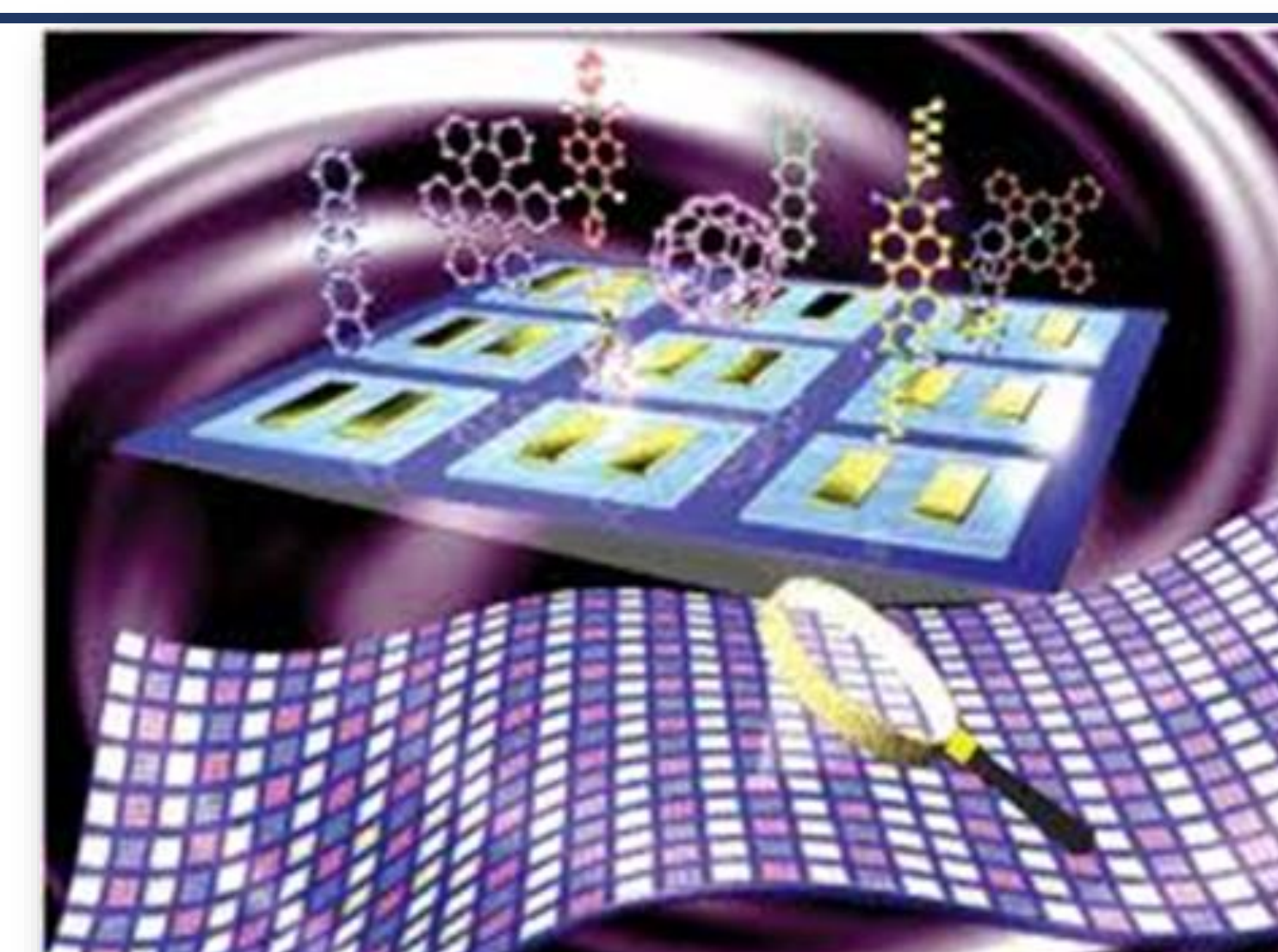
- Synthesis of novel small liquid crystal molecule (10-OPDA), monomer (10-OPDA functionalized) and polymer (poly 10-OPDA)
- Characterization of molecular structure by <sup>1</sup>H NMR
- Characterization of thermo-physical properties and phase behavior by DSC and POM

## REFERENCES

- K. Kondratenko et al., Phys. Chem. Chem. Phys., vol. 23, p. 13885-13894, 2021.
- A. Marotta et al., RSC Adv., vol. 8, p. 16330-16335, 2018.
- S. Radl et al., Polymer, vol. 109, p. 349-357, 2017.

## PERSPECTIVES

- Thin film deposition of the materials
- Charge transport applications (OFET)
- Thermoelectric application



## ACKNOWLEDGEMENT

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