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

A. MOGHNIEH¹, P-E DANJOU², K. FERCHICHI¹, Y. BOUSSOUALEM¹, K. KONDRATENKO¹, I. CARLESCU³, A. DAOUDI¹

¹ Unité de Dynamique et Structure des Matériaux Moléculaires (UDSMM) UR 4476, ULCO, 145 Avenue Maurice Schumann 59140 Dunkerque, France.

² Unité de Chimie Environnementale et Interactions sur le vivant (UCEIV) UR 4492, ULCO, 145 Avenue Maurice Schumann 59140 Dunkerque, France.

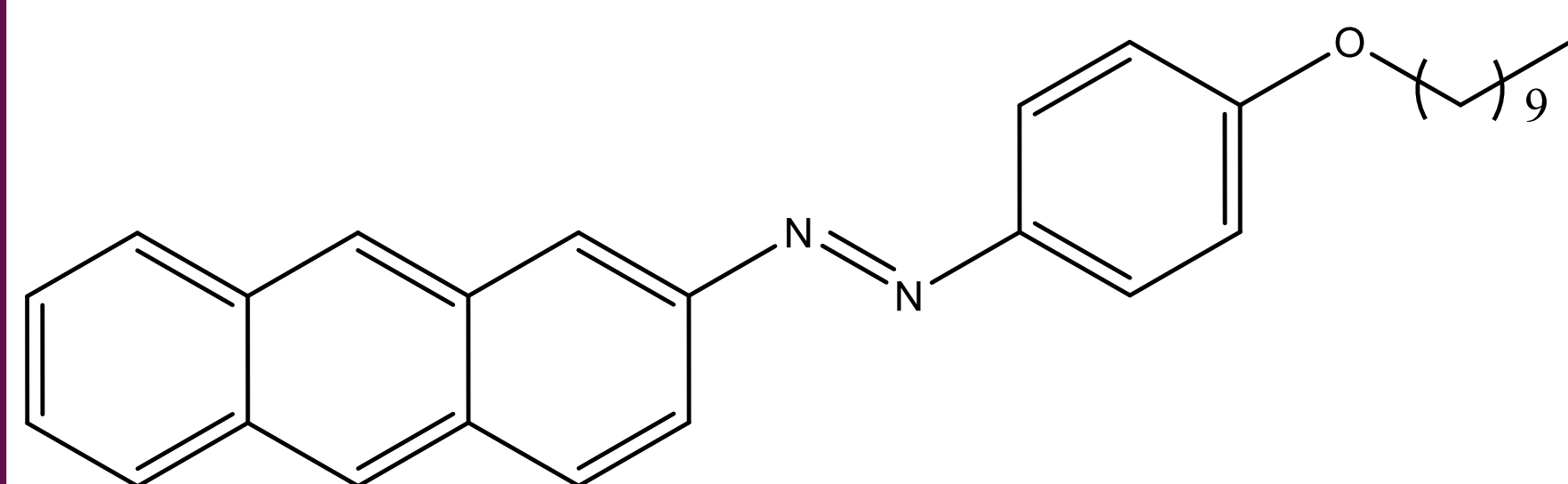
³ Département des polymères naturels et synthétiques, "Cristofor Simionescu". Faculté de génie chimique et de protection de l'environnement, Université technique de Iasi "Gheorghe Asachi", 700050 Iasi, Roumanie.

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.

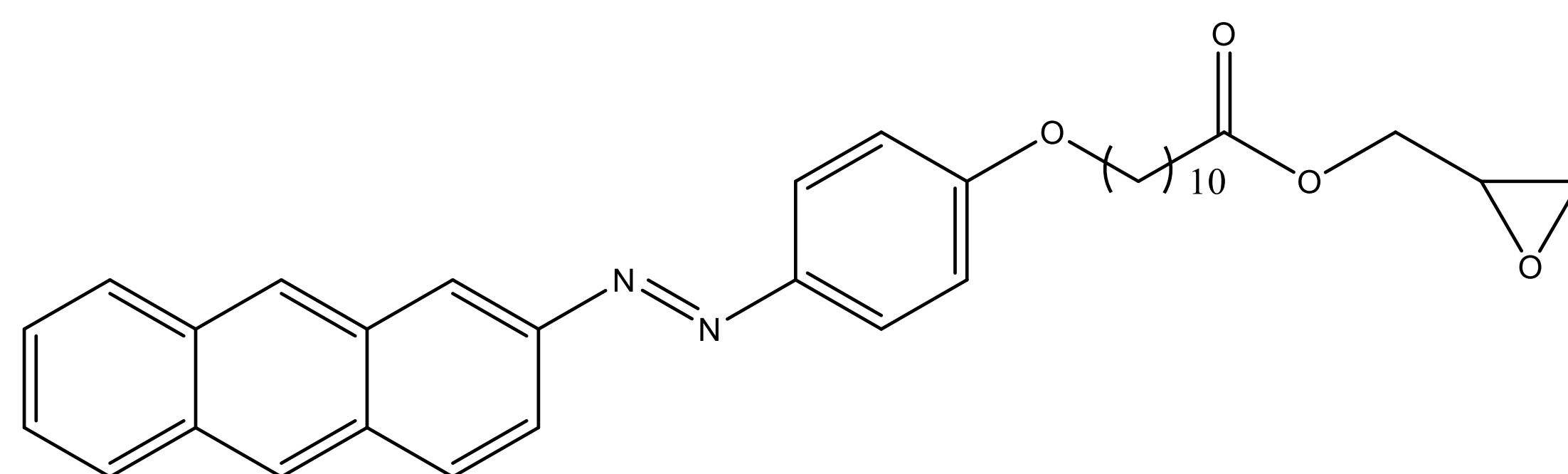
CHEMICAL SYNTHESIS

10-OPDA



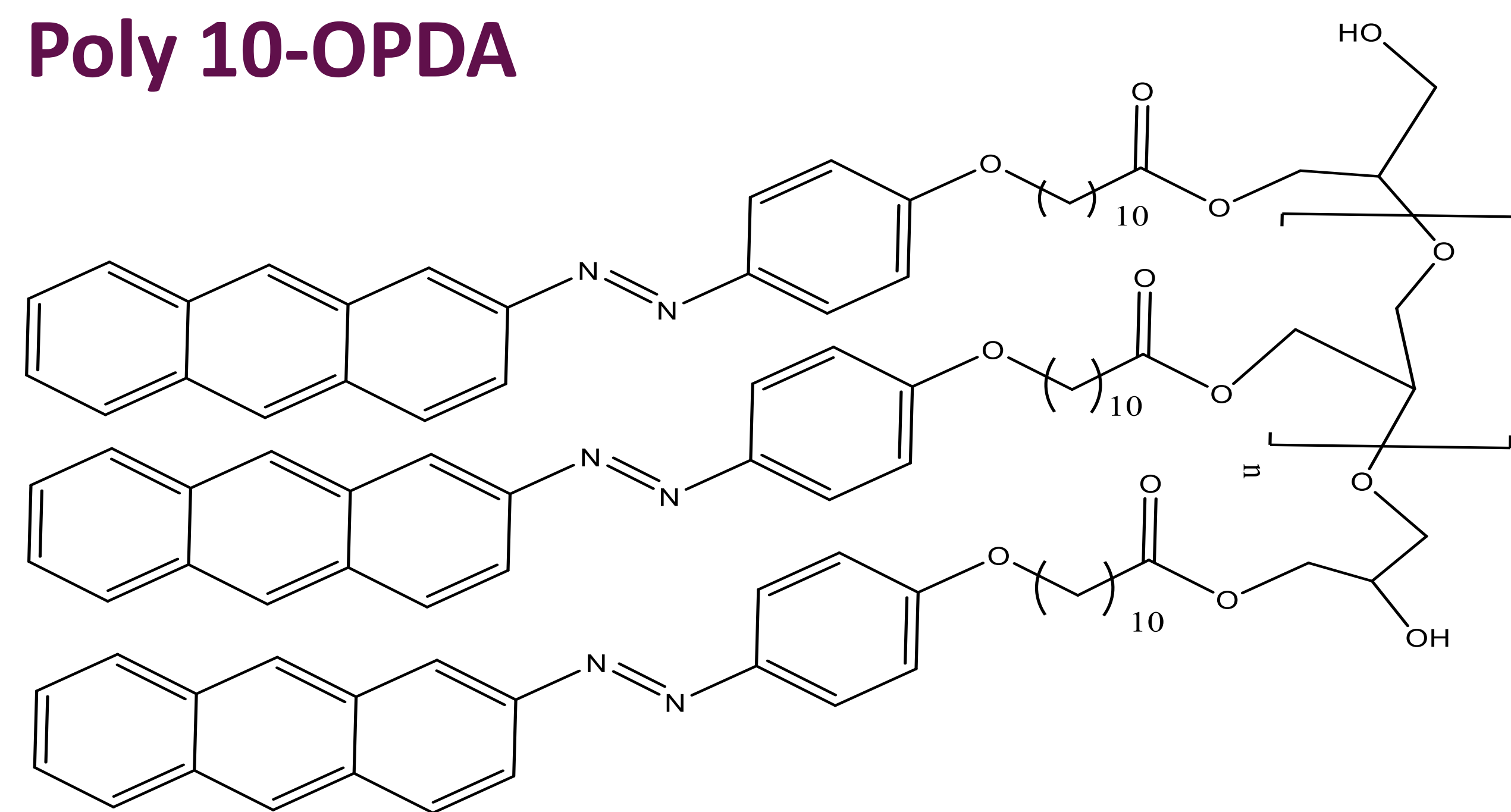
10-OPDA was synthesized in three steps diazotization, azo-coupling and alkylation. It was characterized by ¹H NMR

Functionalized 10-OPDA



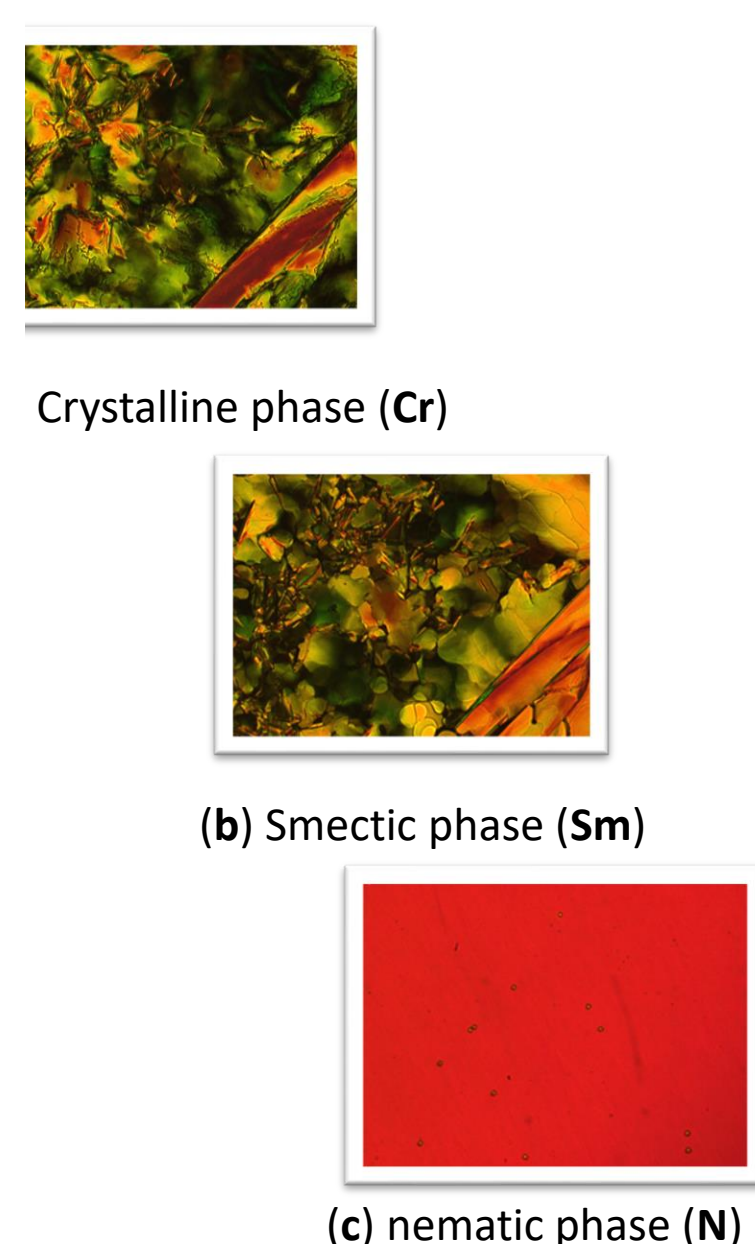
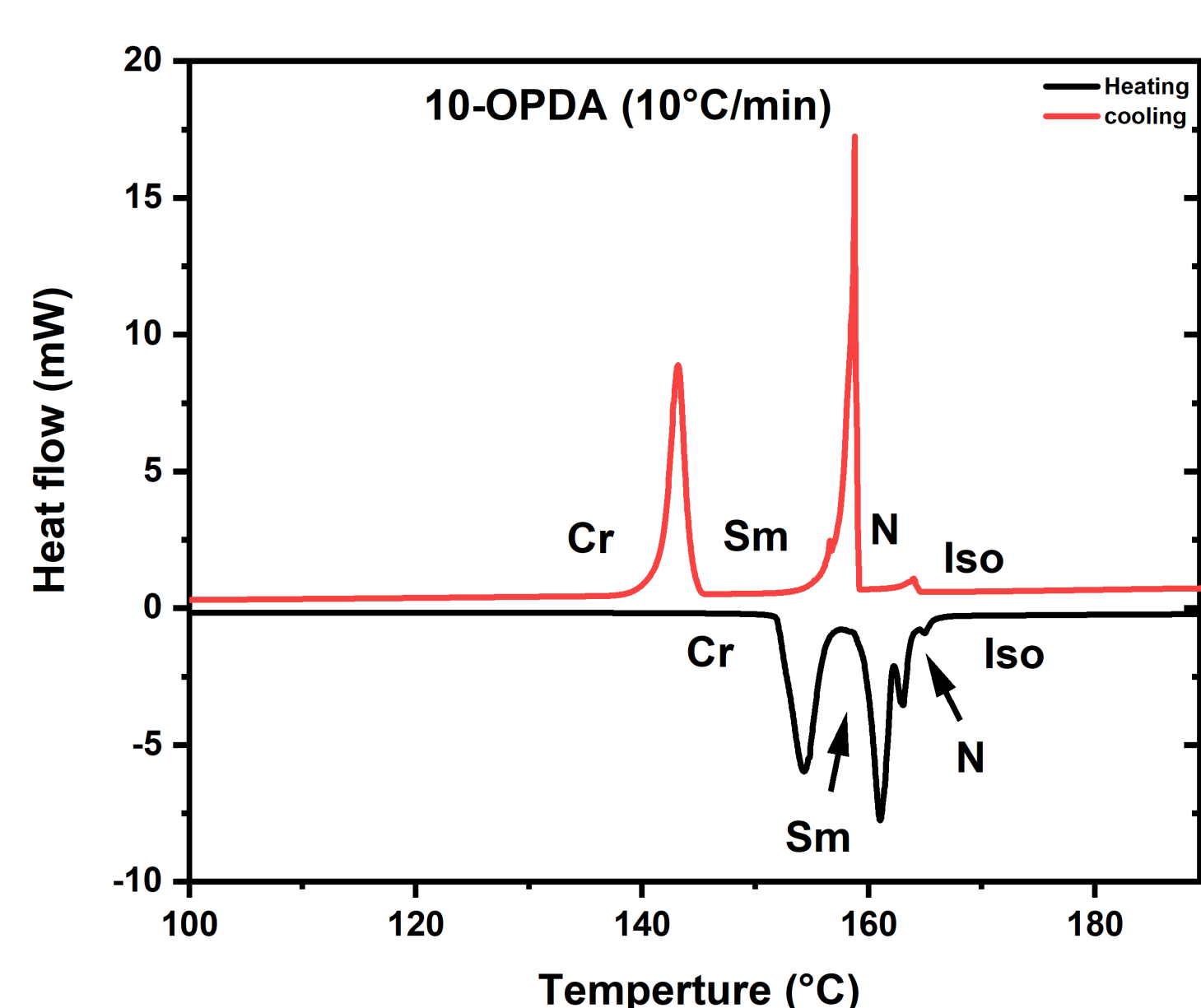
Functionalized 10-OPDA (monomer) was synthesized in five steps diazotization, azo-coupling, alkylation, saponification and esterification with epichlorohydrin. It was characterized by ¹H NMR

Poly 10-OPDA



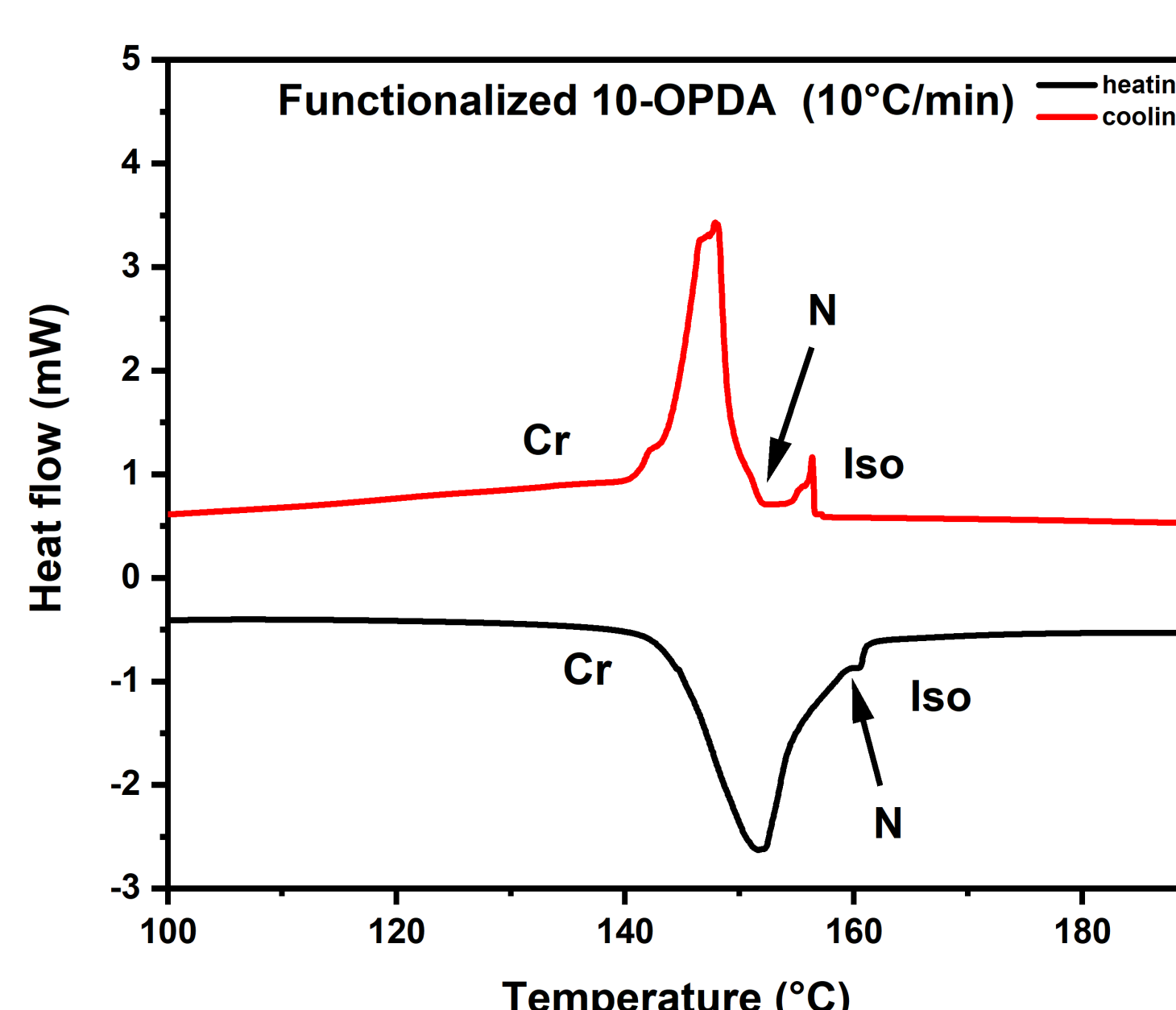
Poly 10-OPDA (polymer) was synthesized by photo-thermal polymerization using NITF as photoacid generator under UV light (1 h at 254 nm, 0.025 mW/cm²) for the initiation step and heating (24 h at 180 °C) for the propagation and termination steps. It was characterized by ¹H NMR

PHASE BEHAVIORS

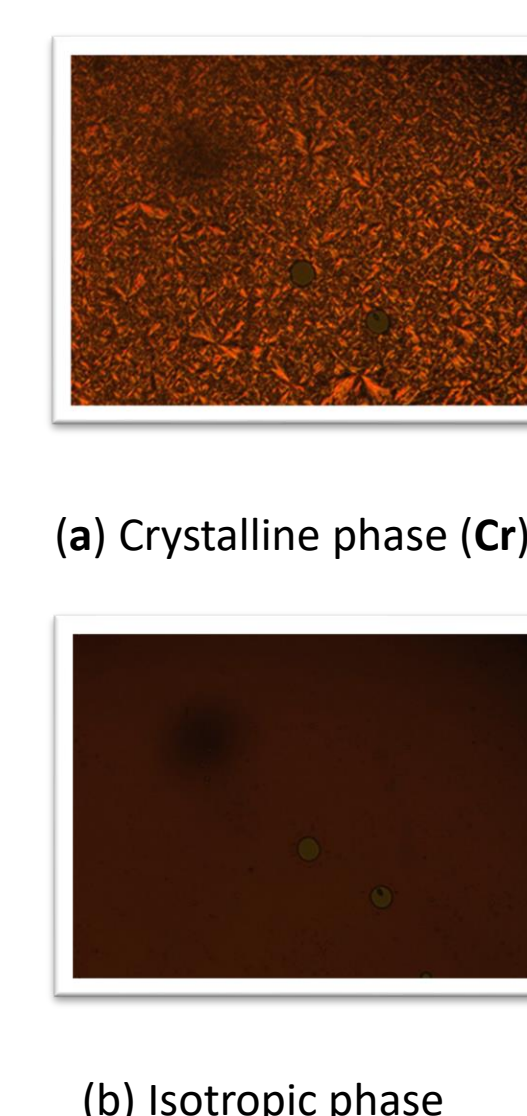
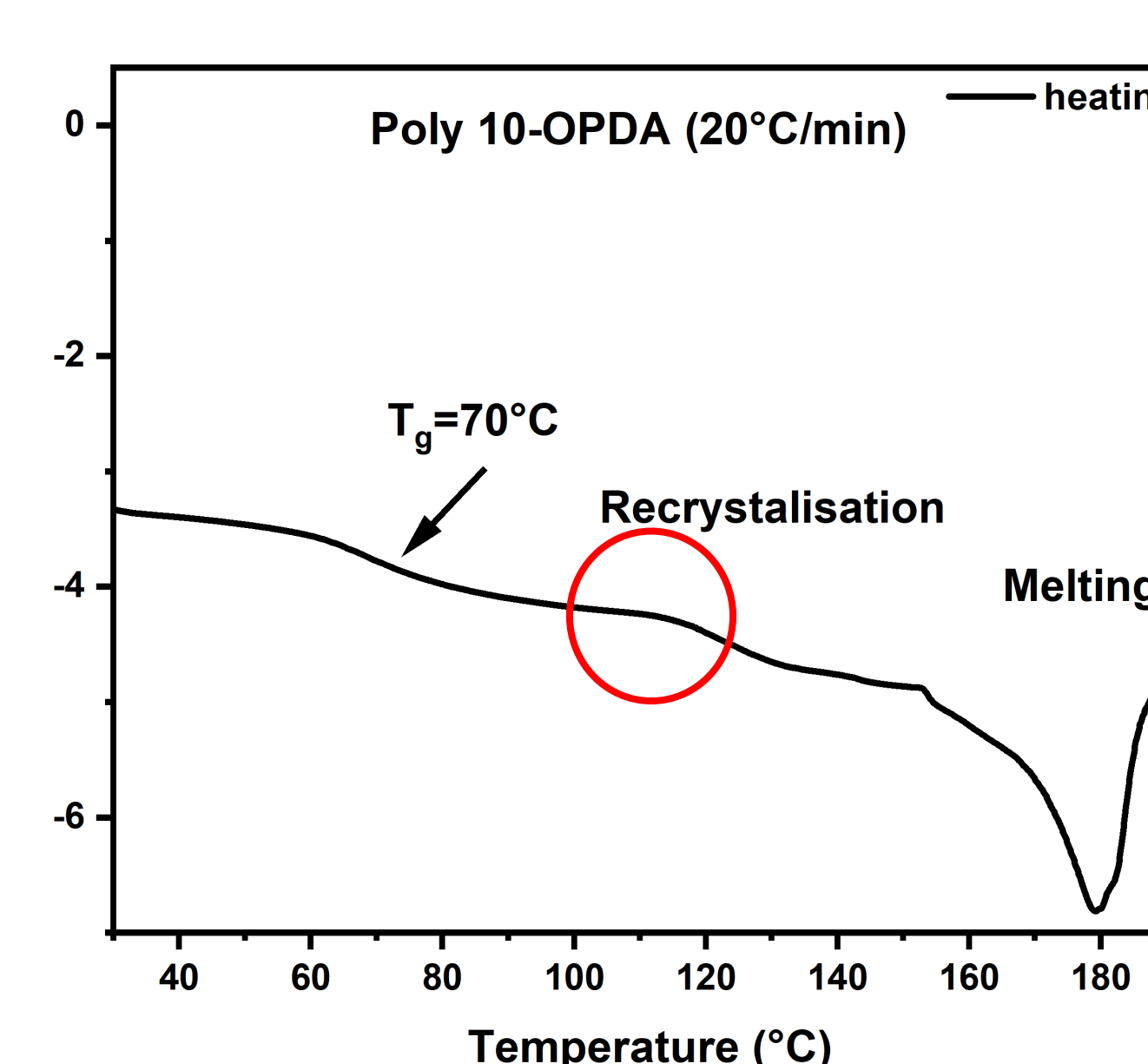


DSC thermograms of 10-OPA sample exhibits reversible mesomorphic behavior, evidenced by 3 phase transitions: Cr-Sm, Sm-N and N-Iso.

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_g) at 70°C, hot recrystallization and melting.

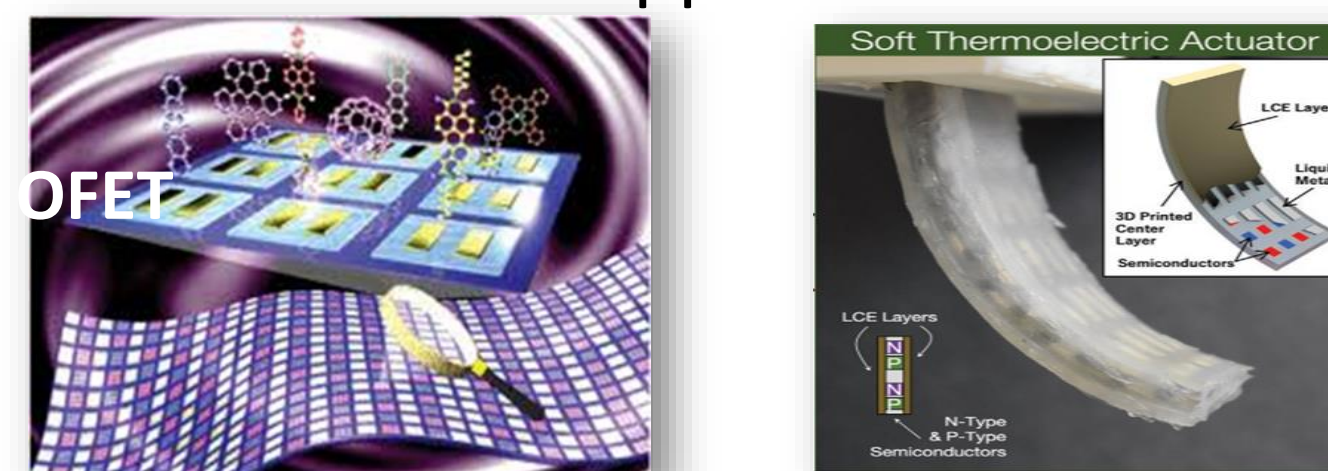
Textures observed by POM for poly 10-OPDA on cooling. (a)- Cr at 175°C and (b)- Iso at 180°C.

CONCLUSION

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

PERSPECTIVES

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



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