

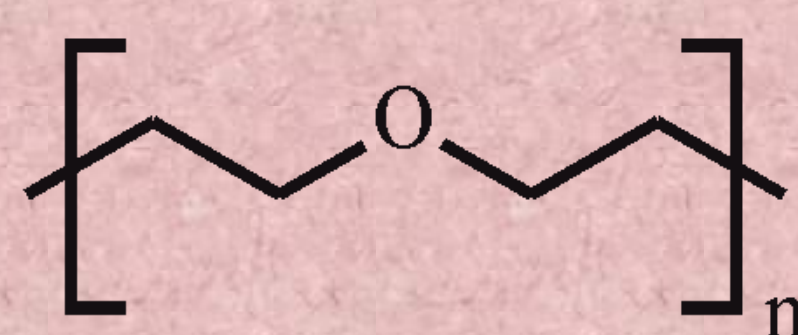
# STUDY OF THE MISCIBILITY BETWEEN PE-b-PEO BLOCK COPOLYMER AND HOBC OR EBBA LIQUID CRYSTALS

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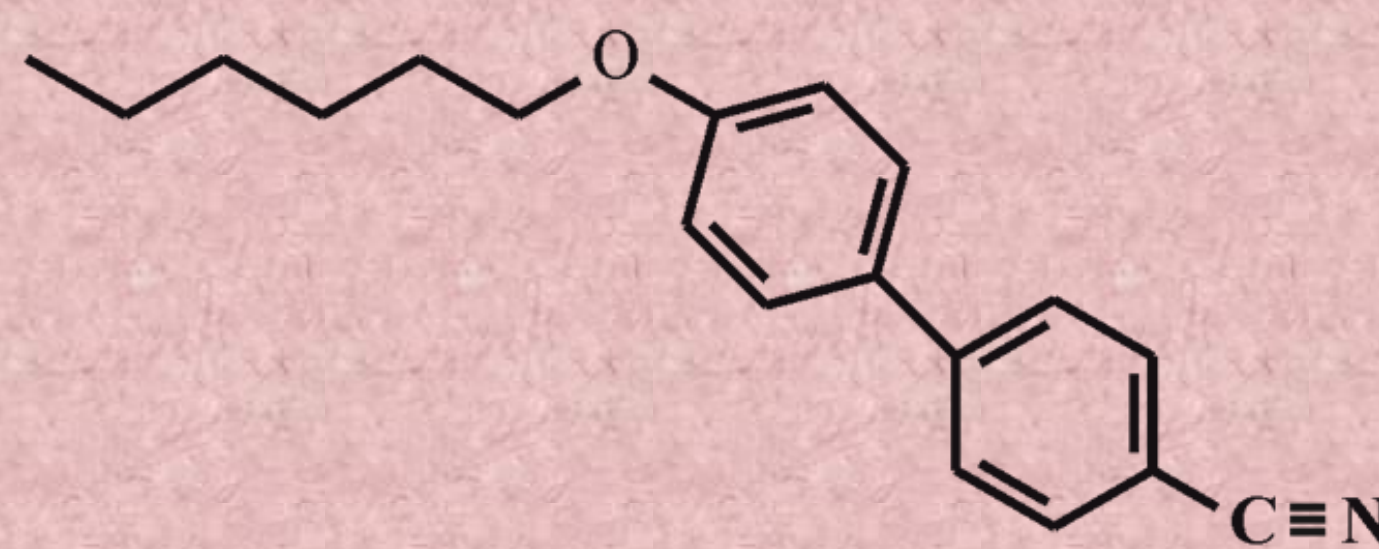
Polymer dispersed liquid crystals (PDLC) blends were fabricated employing PE-b-PEO block copolymer and two different types of low molecular weight liquid crystals (LC) in order to study their miscibility and thermal stability. Optical and thermal properties and the effect of the addition of block copolymer on the final morphology of designed materials were investigated using transmission optical microscopy (TOM) and differential scanning calorimetry (DSC).

## Block copolymer

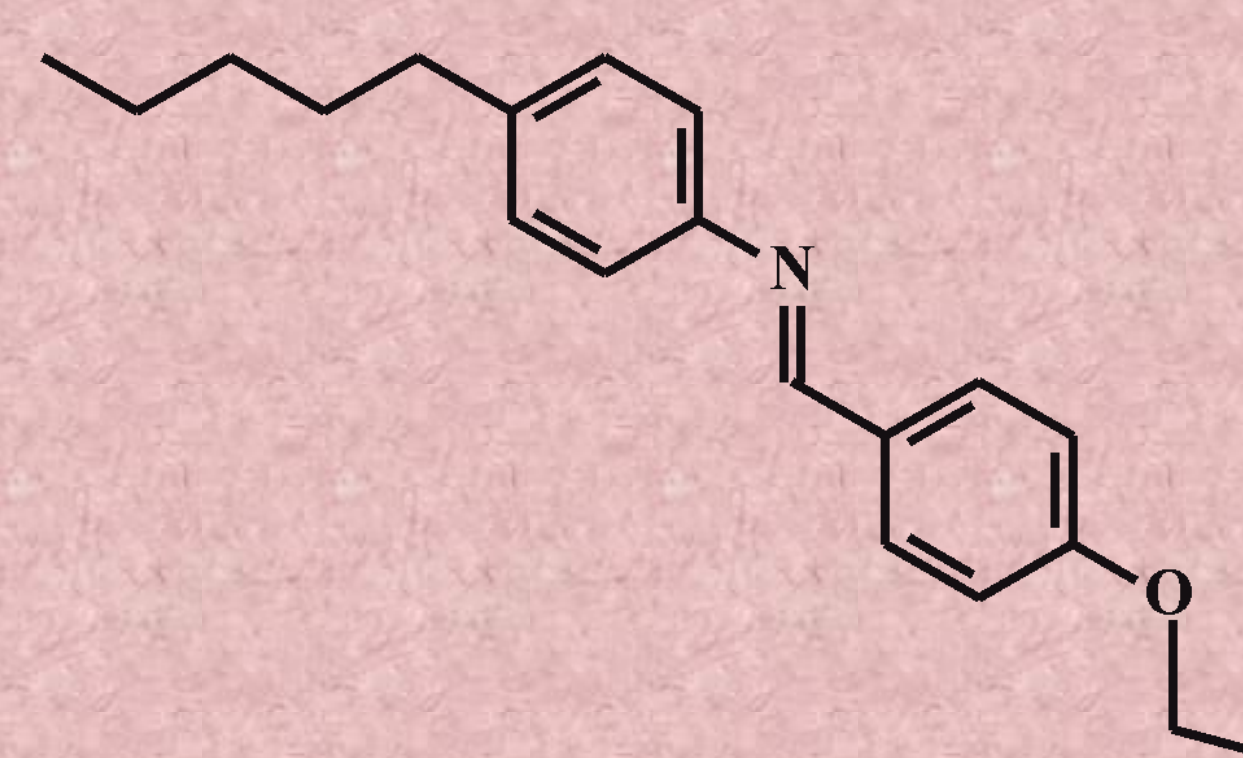


Poly(ethylene-b-ethylene oxide) block copolymer (PE-b-PEO)

## Liquid crystals



4'-(hexyloxy)-4-biphenylcarbonitrile (HOBC)



N-(4-ethoxybenzylidene)-4-butylaniline (EBBA)

• PDLC blends were fabricated by melting in an oven at 100 °C during 1 h and stirred manually to promote their mixing

## DIFFERENTIAL SCANNING CALORIMETRY (DSC)

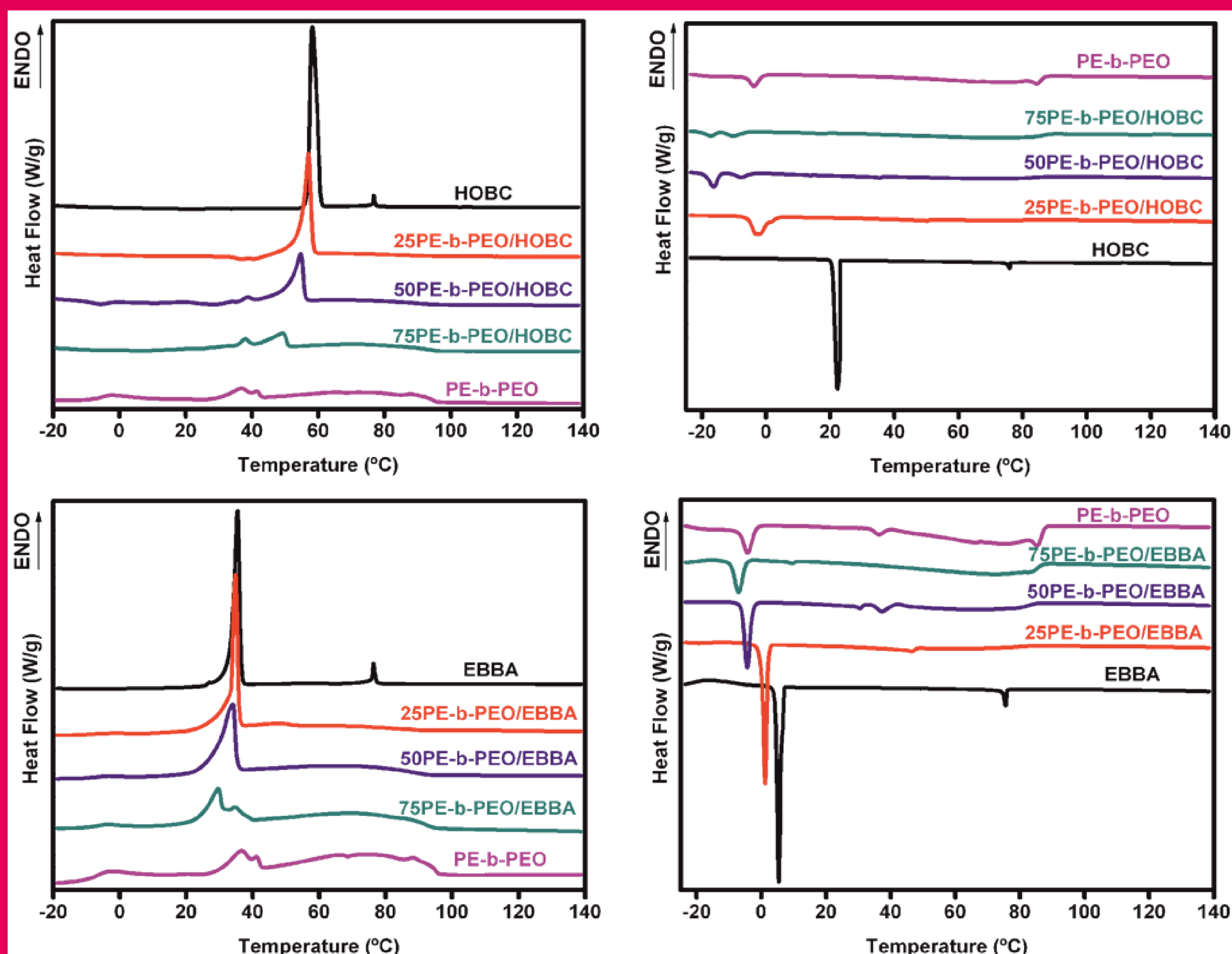


Figure 1. DSC thermograms of PE-b-PEO block copolymer, HOBC and EBBA liquid crystals and blends with 25, 50 and 75 wt % of PE-b-PEO block copolymer

## TRANSMISSION OPTICAL MICROSCOPY (TOM)

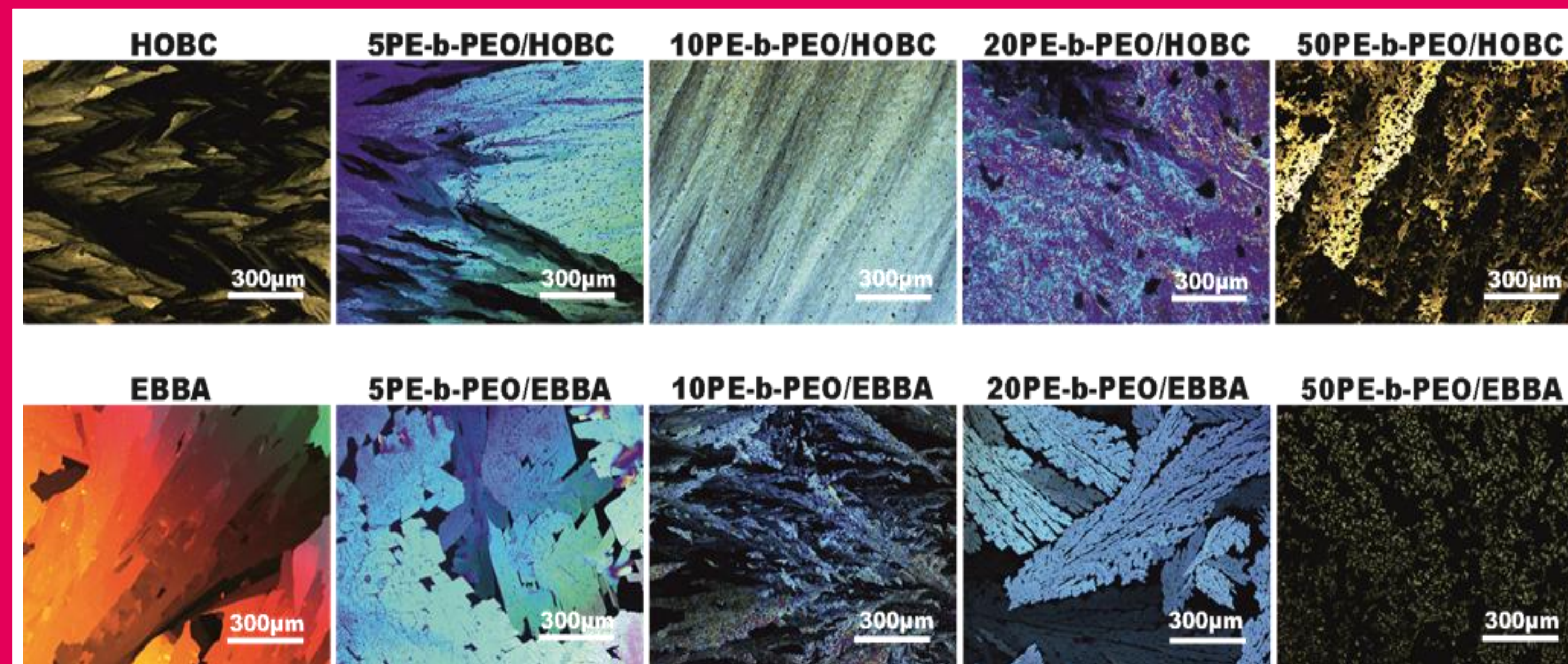


Figure 2. OM micrographs of a) HOBC liquid crystal and PE-b-PEO/HOBC blends and b) EBBA liquid crystal and PE-b-PEO/EBBA blends

• OM micrographs of HOBC and EBBA nematic liquid crystal confirmed their crystalline character at room temperature. In both cases, spherulitic morphology were clearly visualized

• Under the same measurement conditions, addition of PE-b-PEO block copolymer led to changes in the morphology. The size of the spherulites of LC phase in PEO-b-PE/LC blends became smaller with increase of PEO-b-PEO block copolymer

• Higher content of PEO-b-PE block copolymer in PEO-b-PE/LC blends provoked separation of BCP within crystallization of LC phase as clearly visualized for blends with 50 wt % of LC

• Optical microscopy studies indicated that the LC maintains its optical properties in blends up to 50 % by weight of block copolymer

## CONCLUSIONS

- Addition of PE-b-PEO block copolymer lead to notable decrease of the  $T_m$  of both LC phases in PDLC blends if compare with  $T_m$  of neat LCs
- PE block of PE-b-PEO block copolymer is miscible with the EBBA liquid crystal while PEO block of PE-b-PEO block copolymer is miscible with HOBC proving partial miscibility between the BCP and the LCs
- Thermal behaviour of PDLC is in good agreement with calculated solubility parameters
- Addition of the PE-b-PEO block copolymer hindered crystallization process

## References

- [1] Gao C., Zhang S., Li X., Zhu S., Jiang Z., Polymer, 55 (2014) 119-125
- [2] Panapitiya N. P., Wijenayake S. N., Huang Y., Bushdiecker D., Nguyen D., Ratanawanate C., Kalaw G. J., Gilpin C. J., Musselman I. H., Balkus Jr K. J., Ferraris J. P., Polymer, 55 (2014) 2028-2034
- [3] Tercjak A., Serrano E., Larrañaga M., Mondragon I., Journal of Applied Polymer Science, 108 (2008) 1116-1125
- [4] Carrasco-Hernandez S., Gutierrez J., Cano L., Tercjak A., European Polymer Journal, 74 (2016) 148-157

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