

Effect of Composition and Confinement on Mesomorphic and Glass-Forming Behaviour of LC Binary Mixtures

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Multicomponent mesogenic systems are of particular interest due to their potential for tailoring the physicochemical properties of liquid-crystalline (LC) materials. Understanding phase behaviour in bulk and under spatial confinement is crucial for specific applications such as LC thermography [1]. Spatial confinement, such as electrospun fibres or nanoporous membranes, restricts molecular mobility and can strongly influence mesophase formation, vitrification, and crystallization processes. A series of binary LC mixtures with varying molar compositions was prepared. The first component was a mesogenic azo compound from the (E)-4-((4-alkyloxyphenyl)diazanyl)phenyl alkanooates group (*n*OABOOC_{*m*}, for *n* = 3, 5, 7, 8, 10, and *m* = 1-19) [3-5], while the second component was a chiral LC, cholesteryl pelargonate (PC). Selected mixtures containing PC exhibit glassy SmA* or crystalline phases. The influence of mixture composition on glass-forming ability, thermal stability, and phase formation is discussed.

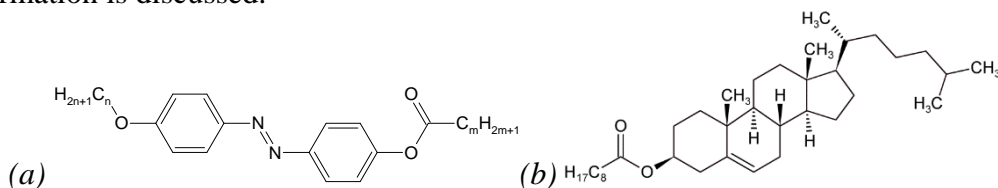


Figure 1. Structural formula: (a) (E)-4-[(4-alkyloxyphenyl)diazanyl]phenyl alkanooates (*n*OABOOC_{*m*}, for *n* = 3, 5, 7, 8, 10 and *m* = 1-19); (b) cholesteryl pelargonate (PC).

Mesomorphic behaviour, thermal properties, dynamic processes, and structural organization were studied using Polarized Optical Microscopy, Differential Scanning Calorimetry, Broadband Dielectric Spectroscopy, and X-ray Diffraction. The observed phenomena include SmA* and crystalline glass formation, melt and cold crystallization, and double-step cold crystallization. Bulk studies were extended to spatially confined systems, including electrospun fibres and nanoporous membranes, using the same techniques complemented by Small-Angle Neutron Scattering and Fourier-transform Infrared spectroscopy. The results demonstrate that confinement significantly modifies mesophase behaviour and glass formation.

References

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Acknowledgments

This research was partially funded by the National Science Centre, Poland, SONATA 20, project no. 2024/55/D/ST3/00892.

We gratefully acknowledge Polish high-performance computing infrastructure PLGrid (HPC Center: ACK Cyfronet AGH) for providing computer facilities and support within computational grant no. PLG/2026/019109.