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Pressure-induced interdigitation in bicellar mixtures containing anionic lipid

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Phospholipid bilayer interdigitation can be induced by the application of hydrostatic pressure. Bilayers of anionic lipid are known to interdigitate at lower pressures than bilayers of corresponding lipids with zwitterionic headgroups. Dispersions of lipid mixtures with long and short chains, known as bicellar mixtures, can exist as small bilayered micelle disks at temperatures below the gel-to-liquid crystal transition temperature of the long chain component, magnetically orientable extended micelles at intermediate temperature, and lamellar phases at higher temperature. For mixtures of dimyristoyl phosphatidylcholine (DMPC) and dihexanoyl phosphatidylcholine (DHPC), interdigitation has been reported at pressures above 400 MPa [Jeworrek, Uelner, Winter, 2011, *Soft Matter* 7, 2709]. In the current work, dispersions DMPC- d_{54} , the anionic phospholipid dimyristoyl phosphatidylglycerol (DMPG), and DHPC, with molar ratios 3:1:1, have been studied using variable-pressure ^2H NMR at temperatures up to 60°C and pressures up to 140 MPa. The resulting pressure-temperature phase diagram displays a region of interdigitation that extends down 120 MPa at 56°C. However, by cooling this mixture from about 50°C at pressures above 83 MPa, it is also possible to induce metastable interdigitation that can persist to lower pressures and temperatures. This may reflect kinetic trapping of a non-equilibrium lateral distribution of the short-chain DHPC component. These observations provide new insights into how lipid assembly morphology is determined by the balance between component interactions in the bilayer interfacial and hydrophobic regions. Supported by NSERC.

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