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New Polymerizable Borate Ionic Liquid Crystals

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Ionic liquid crystals (ILCs) have a strong tendency to self-assemble into highly ordered lamellar, columnar or cubic mesophases, due to the pronounced cohesive energy density difference between their aliphatic and polar moieties. The inherent ability to align, coupled with high ionic conductivity, makes ILCs highly promising candidates for advanced solid-state electrolytes [1]. However, ILCs featuring immobilized borate anions remain largely unexplored [1b, 2]. Weakly nucleophilic carboxy borates such as $K[B(CN)_3COOH]$ minimize cation-anion interactions [3]. Their esterification with non-polar aliphatic-aromatic scaffolds immobilizes the anions, creating effective single-ion conductors **1a** (Fig. 1), in which only the counter cations remain mobile [4].

In this study, novel borate-based ILCs **1b** and **1c** were synthesized, incorporating alkali metal cations in the presence of [18]crown-[6] as coordinating sites. Recent studies showed that the SmA_2 phases were only monotropic below 50 °C and did misalign after several heating cycles. Therefore, current efforts aim the synthesis of polymerizable derivatives to permanently lock the macroscopically aligned mesophases via *in-situ* polymerization. It is hypothesized that fixing the ordered supramolecular structure within a polymer network will preserve its structure well beyond the temperature range of the original enantiotropic mesophase. Furthermore, this structural fixation is anticipated to provide robust pathways for continuous ion transport, potentially leading to enhanced macroscopic ionic conductivity in the resulting solid-state materials.

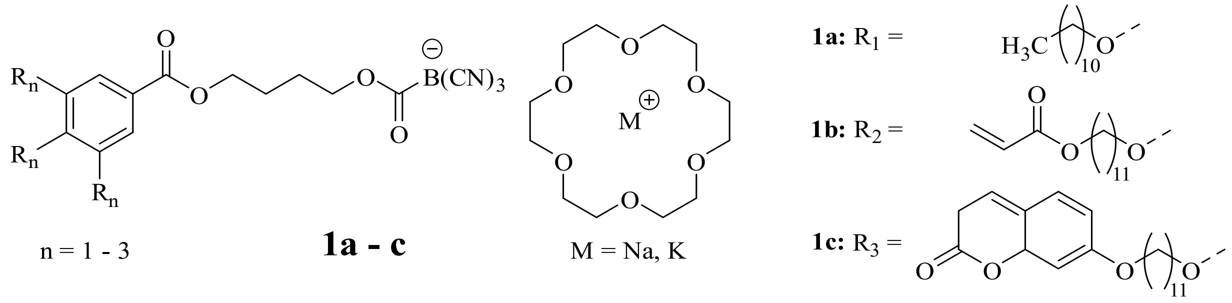

Figure 1. Overview of the synthesized polymerizable anionic borate anions.

References

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