SYNTHESIS AND CHARACTERISATION OF NOVEL IONIC LIQUID CRYSTALS-BASED ON SUBSTITUTED PYRIDINIUM CATIONS

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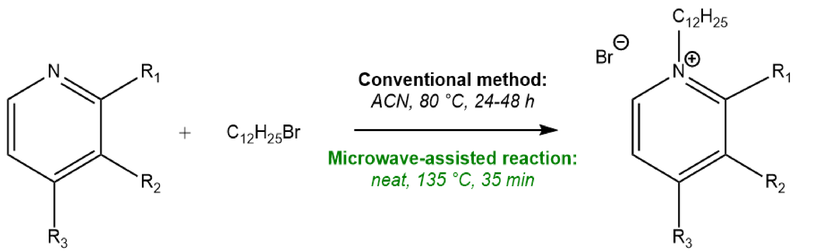
1. MOTIVATION

Thermotropic Ionic Liquid Crystals (ILCs) are a class of anisotropic compounds that contain cations and anions, allowing to design new functional materials with the characteristics of both ionic liquids (high chemical and thermal stability, high ionic conductivity and large electrochemical windows) and liquid crystals (dynamic molecular order, anisotropic physical properties, self-assembling ability). These materials have been applied in several fields and, in order to understand how the presence, location and the size of the methyl group influences the liquid crystalline behaviour, several ionic liquid crystals based on substituted pyridinium cations were prepared and characterised.

2. SYNTHESIS OF ILC

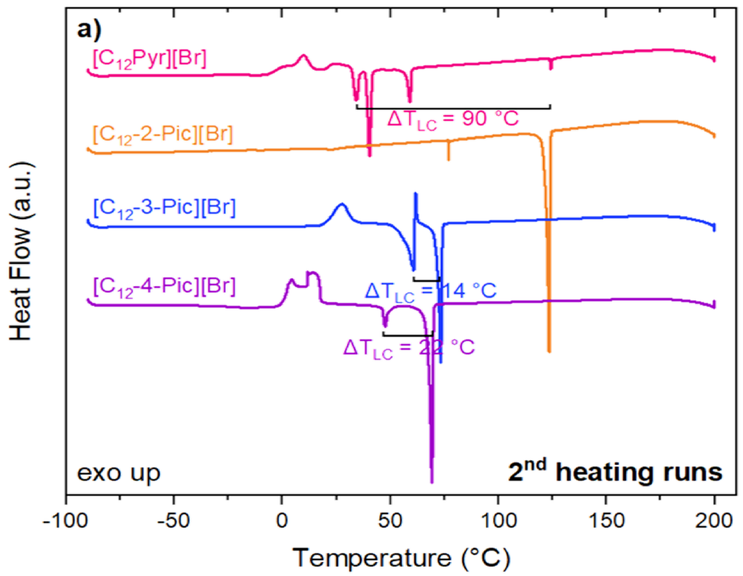


MW-assisted reaction is a more efficient, greener and faster process (no solvent; 35 min; >95% yield)

R_1=R_2=R_3=H	[C_{12}Pyr]Br
R_1=Me, R_2=R_3=H	[C_{12}-2-Pic]Br
R_2=Me, R_1=R_3=H	[C_{12}-3-Pic]Br
R_3=Me, R_1=R_2=H	[C_{12}-4-Pic]Br

3. RESULTS AND DISCUSSION

- **Thermal Analyses by DSC:**



[C_{12}Pyr][Br]: 3 liquid crystal (LC) transitions and a large LC window

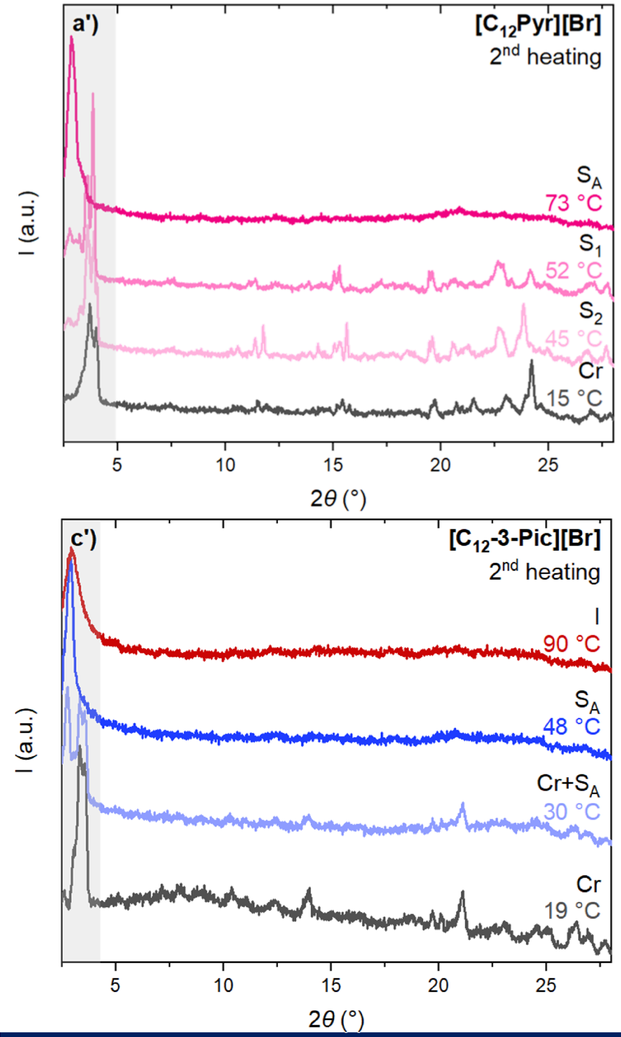
[C_{12}-2-Pic][Br] exhibits polymorphism and seems to be a smectic crystal

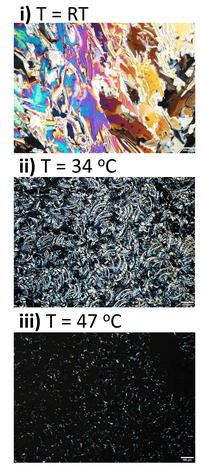
[C_{12}-3-Pic][Br]: 1 LC transition with a small LC window

[C_{12}-4-Pic][Br]: 1 LC transition with a small LC window

- **[C_{12}Pyr][Br]:** 3 smectic phases (S_1, S_2 and S_A)
- **[C_{12}-3-Pic][Br]:** 1 smectic phase (S_A)

- **X-Ray Diffraction & POM studies:**





4. CONCLUSIONS

- All prepared ILCs were detailed characterised by spectroscopic, thermal and microscopic analysis;
- Pyridinium and Picolinium ILCs exhibiting smectic phases;
- A small modification at molecular level provokes significantly impact in the liquid crystalline behaviour.

New promissory smart materials based on ILCs have been developed → **Future application in display devices**

References: [1] K. Goossens, K. Lava, C. W. Bielawski, K. Binnemans, Chemical Reviews 2016, 116, 4643–4807; [2] L. Douce, J.-M. Suisse, D. Guillon, A. Taubert, Liquid Crystals 2011, 38, 1653–1661.

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