Crystals 2022

The 3rd International Online Conference on Crystals

15–30 JANUARY 2022 | ONLINE

Chaired by PROF. DR. HELMUT CÖLFEN

crystals MDPI

Study of the critical behaviour in the vicinity of various phase transitions associated with two antiferroelectric enantiomers R-MHPOBC, S-MHPOBC and their racemic mixture

Barnali Barman

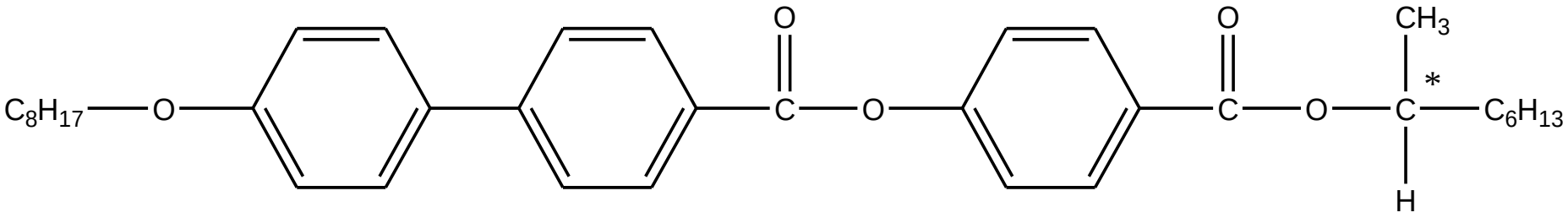
Department of Physics, University of North Bengal, 734 013, Siliguri

West Bengal, India

* Corresponding author: barnalibarman1991@gmail.com

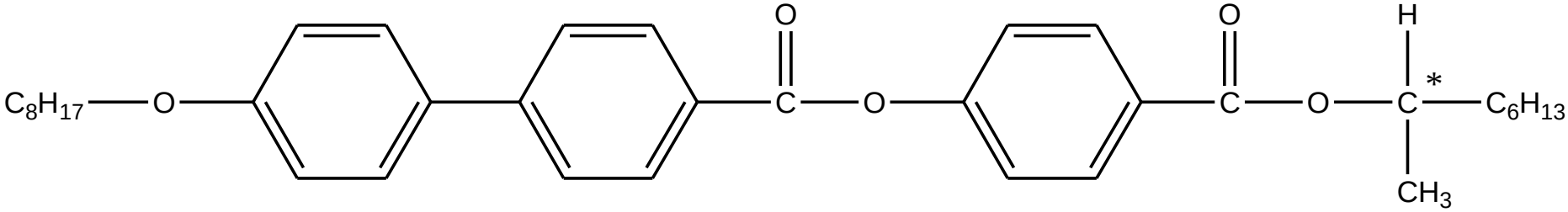
MATERIALS UNDER INVESTIGATIONS

R-MHPOBC [Molecular Weight (M) = 558.762 a.m.u]



Cr 357K SmC_A^* 391.6 K SmC_γ^* 392.4K SmC^* 394.1K SmC_α^* 395.2 K SmA 421.0K Iso

S-MHPOBC [Molecular Weight (M) = 558.762 a.m.u]



Cr 357 K SmC_A^* 391.4 K SmC_γ^* 392.2 K SmC^* 393.9 K SmC_α^* 395 K SmA 421 K Iso

A racemic mixture of MHPOBC shows a different phase sequence

Cr 357 K SmC_A 386 K SmC 394 K SmA 420 K Iso

A Racemic mixture does not have chirality as a whole.

Crystals 2022

From MDSC-Method

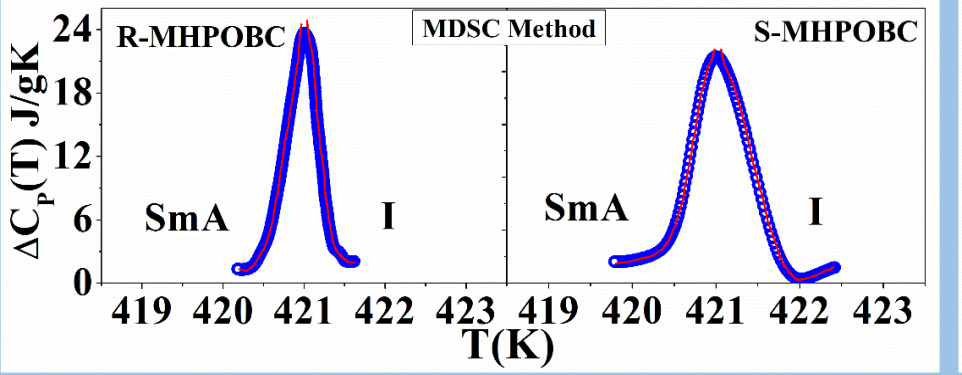
$$C(T) = -[H(T) - H(T_C)]/[T - T_C]$$

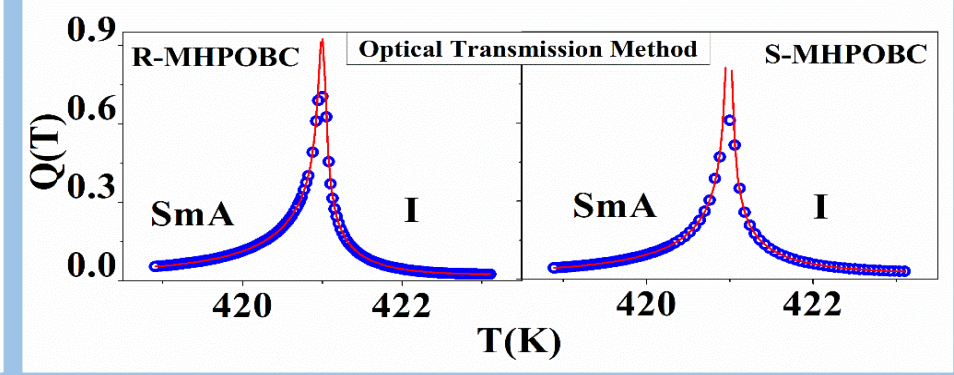
$$\Delta C_P(T) = \frac{A^{\pm}}{\alpha}|t|^{-\alpha}\left(1 + D^{\pm}|t|^{\Delta}\right) + E(T - T_C) + B$$

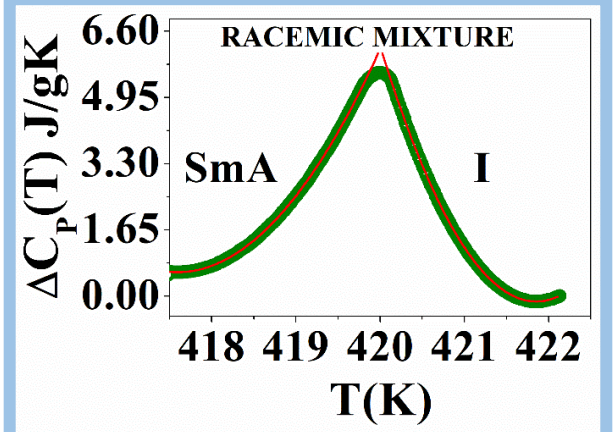
From Optical Transmission Method

$$Q(T) = -[\Delta n(T) - \Delta n(T_C)]/[T - T_C]$$

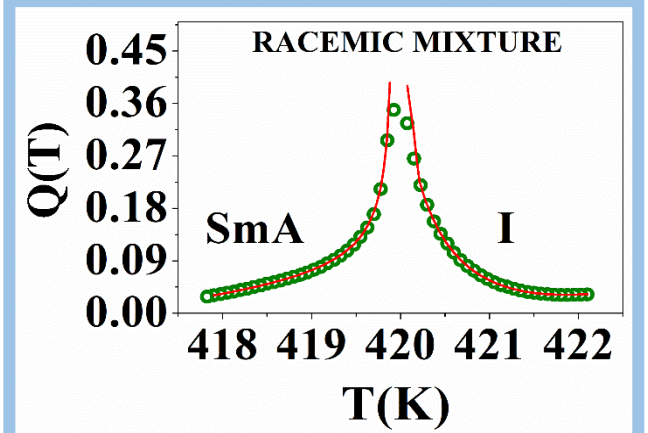
$$Q(T) = \frac{A^{\pm}}{\alpha'}|t|^{-\alpha'}\left(1 + D^{\pm}|t|^{\Delta}\right) + E(T - T_C) + B$$







On entering from isotropic phase to SmA phase a large peak is observed in specific heat capacity and a large jump occurs in the birefringence value which indicates the first order nature of this transition.



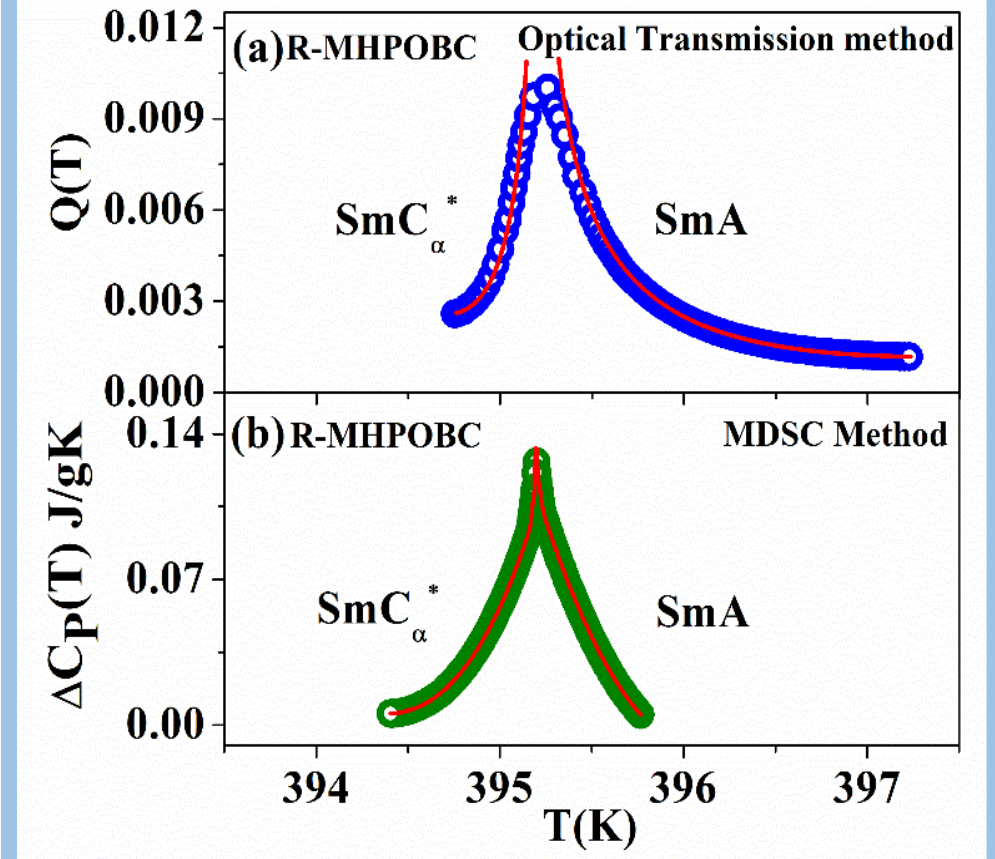
To check the behaviour the critical exponent extracted from both $\Delta C_P(T)$ and Q(T) using the renormalization group expression gives a value of about 0.5 which confirms that the isotropic to SmA phase transition is first order in nature.

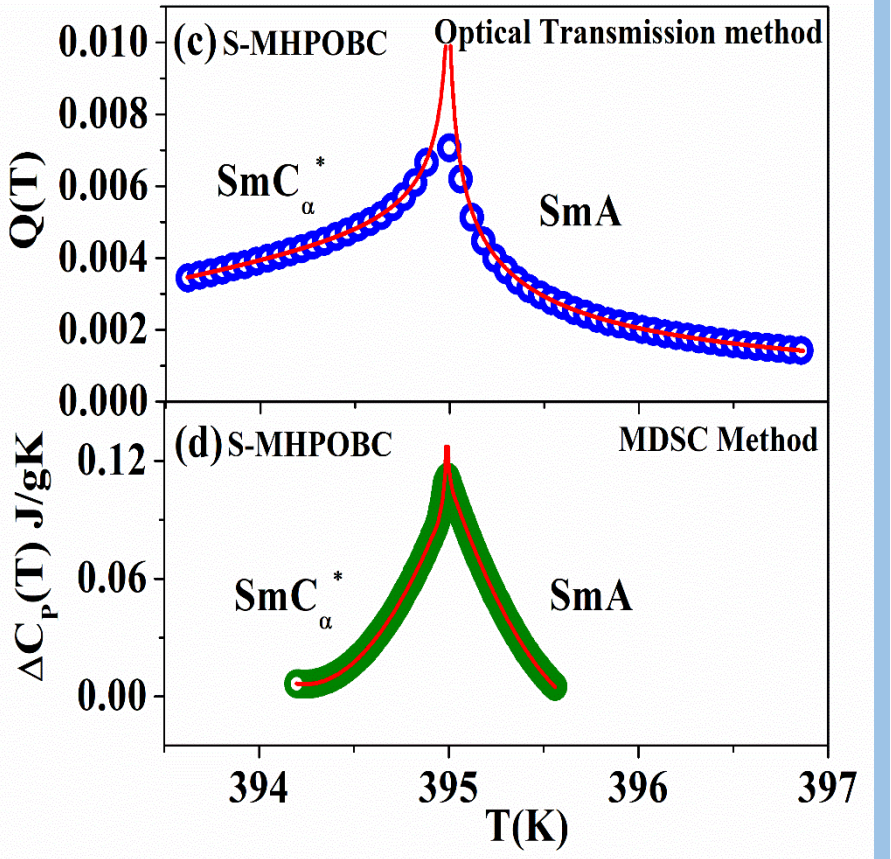
Crystals 2022

SmA-SmC$_\alpha^*$ phase transition

R-MHPOBC

S-MHPOBC

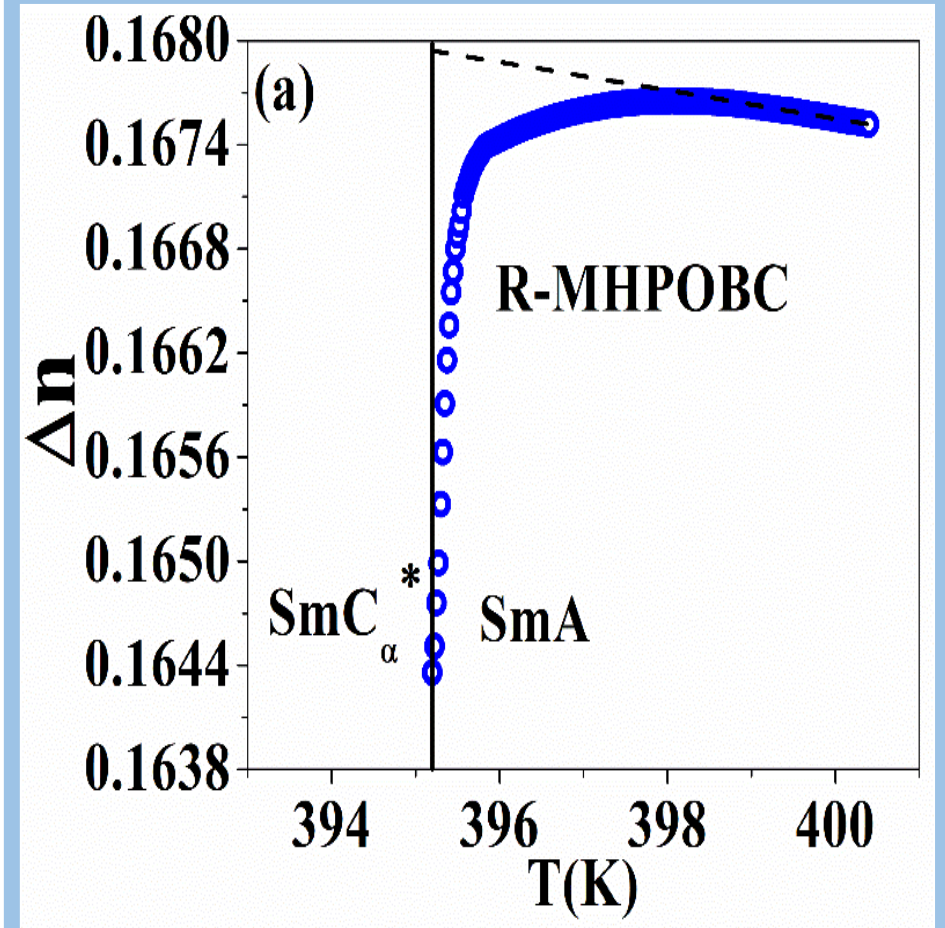


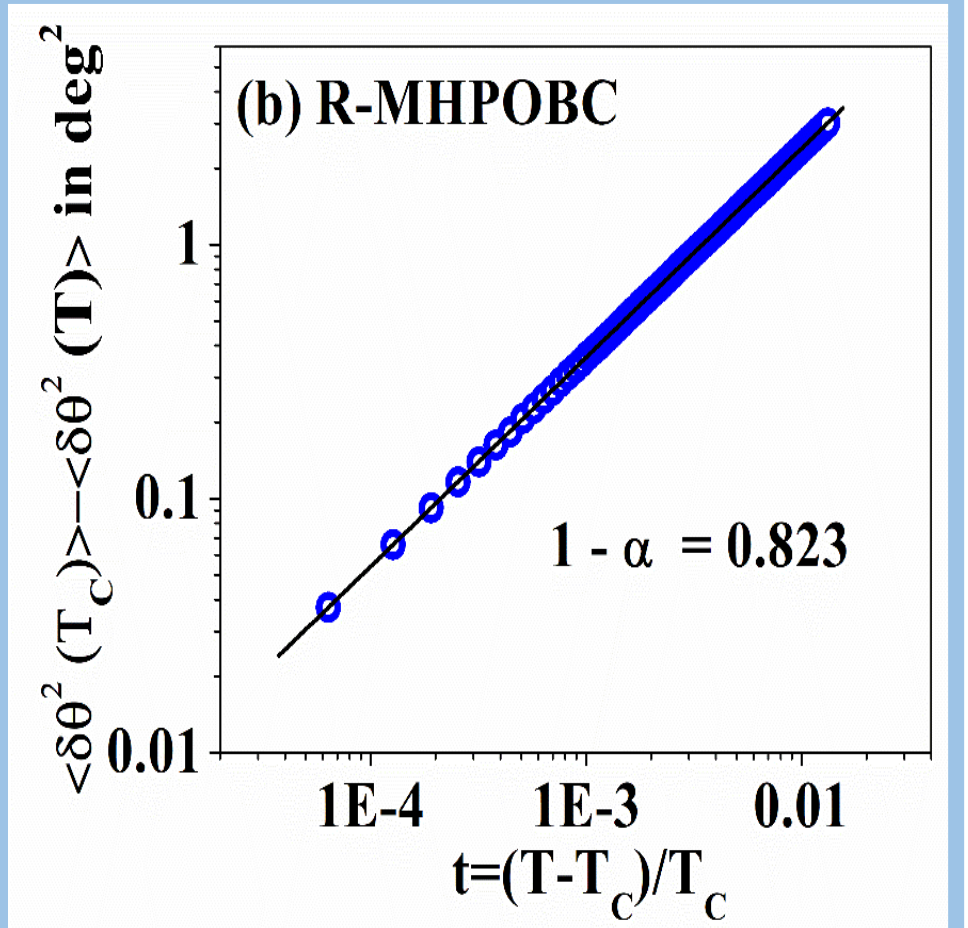


The specific heat capacity anomaly shows a small peak corresponding to this transition both for R and S-enantiomers. The extracted critical exponent clearly indicates the second order nature of this transition.

Crystals 2022

Critical exponent from Birefringence Suppression near SmA-SmC$_\alpha^*$ phase transition of R-MHPOBC





The value of the specific heat capacity critical exponent (α) for R-MHPOBC found from the critical part of the tilt angle fluctuations <δθ^2(T)> is 0.177 which is equal to the critical exponent (*α′*) explored from Q(T) fitting.

Crystals 2022

Acknowledgements

- **Barnali Barman** is grateful to Department of Science and Technology, DST-INSPIRE, New Delhi [DST/INSPIRE Fellowship/2015/IF150049] for financial support as a Junior Research Fellowship.
- **Prof. Malay Kumar Das** has highly acknowledged for his valuable Guidance.

Crystals 2022

THANK YOU

Crystals
2022