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On: 23 February 2013, At: 04:03

Publisher: Taylor & Francis

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Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



Molecular Crystals and Liquid Crystals

Publication details, including instructions for authors and subscription information:

http://www.tandfonline.com/loi/gmcl16

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To cite this article: A Levstik , B Žekš , I Levstik , R Blinc & C Filipič (1980): Dielectric Dispersion in

Dobambc, Molecular Crystals and Liquid Crystals, 56:5, 145-149

To link to this article: http://dx.doi.org/10.1080/01406568008070902

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Mol. Cryst. Liq. Cryst. Vol. 56 (Letters), pp. 145-149 0140-6566/80/5605-0145\$04.50/0 © 1980, Gordon and Breach, Science Publishers, Inc. Printed in the United States of America

DIELECTRIC DISPERSION IN DOBAMBC*

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(Submitted for publication: 19th October, 1979)

Abstract: From the low frequency order parameter fluctuation spectrum of chiral DOBAMBC at the ferroelectric smectic A to C transition, studied by dielectric relaxation spectroscopy, the frequency and dielectric strength of the Goldstone mode for $\mathbf{q}=\mathbf{0}$ in the ferroelectric phase have been determined. The frequency is approximately temperature independent, decreasing slightly when approaching T_C from below, while the intensity decreases for an order of magnitude and goes to zero at T_C .

In our previous study we have reported on the frequency and temperature dependence of the dielectric constant of p-decyloxybenzylidene-p'-amino 2-methylbutyl cinnamate (DOBAMBC) close to the smectic A to smectic C phase transition. The numerical analysis of the same experimental data gives some new information.

In Figure 1 is shown the temperature dependence of the Goldstone mode frequency in the smectic C phase. The circles represent the measured values of the relaxation frequency determined from the Cole-Cole diagrams. The

^{*} Supported by the Research Community of Slovenia

curve represents the fit calculated from a linear regression of log f vs log (T_C -T). The frequency of the Goldstone mode decreases on approaching T_C , where it has a

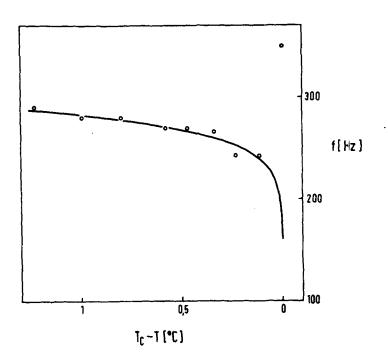


FIGURE 1: The dielectric dispersion frequency as a function of temperature

fixed value. The measured value at $\mathbf{T}_{\mathbf{C}}$ is much higher than the extrapolated value.

Figure 2 shows the corresponding dielectric strength $\varepsilon_0-\varepsilon_\infty$ of the Goldstone mode as a function of temperature. The curve is calculated from a linear regression of log $(\varepsilon_0-\varepsilon_\infty)$ vs log (T_c-T) . As we supposed in the previous study, the intensity of the Goldstone mode really goes to zero at T_c . Again the measured value at T_c is much different from the extrapolated value.

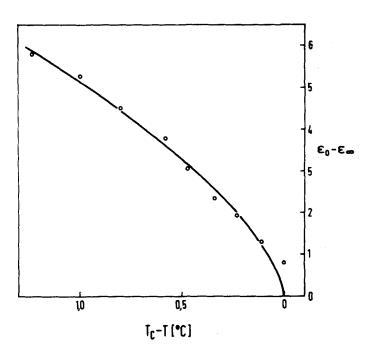


FIGURE 2: The dielectric strength as a function of temperature

The low frequency part of the polarization fluctuation spectrum is expected to have a soft mode behaviour above T_C , while below T_C , it should be a superposition of the soft mode part and the Goldstone part. The soft mode has been determined above T_C by Garoff and Meyer. It is equal to 10 kHz at $T^-T_C = 0.1$ K and decreases critically when approaching T_C . As the dielectric intensity of the soft mode decreases rapidly on going away from T_C , the greatest chance of observing it is just at the temperature of the phase transition. In Figure 3 we make a comparison of the experimental results and the theory developed in the study of Zekš. Neglecting the flexoelectric coupling, the Goldstone mode has a constant value. Using values for viscosity, elastic constant, and pitch from the literature, we get for the Goldstone mode frequency 250 Hz which is close to the measured value. The point at T_C corresponds to the

soft mode frequency which depends critically on temperature.

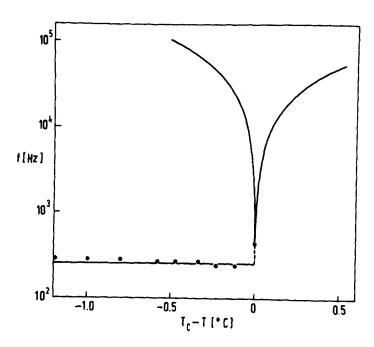


FIGURE 3: The temperature dependence of the Goldstone mode and soft mode.

CONCLUSIONS: With a least mean square analysis of the experimental data we have succeeded in showing that the intensity of the Goldstone mode goes to zero at $T_{\rm C}$, and that the measured point at $T_{\rm C}$ corresponds to a soft mode. The dielectric properties of DOBAMBC close to the smectic A to smectic C transition can be very well described by the model proposed by Žekš. 3

REFERENCES:

- A Levstik, B Žekš, I Levstik, R Blinc, and C Filipič, Jowrnal de Physique, 40, C3-303 (1979).
- S Garoff and B Meyer, Phys Rev Lett, 38, 488 (1977).
- B Žekš, A Levstik, and R Blinc, Journal de Physique, 40, C3-409 (1979).