Molecular Crystals and Liquid Crystals Science and Technology. Section A. Molecular Crystals and Liquid Crystals

Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/gmcl19

Low-Frequency Dielectric Properties of Acenaphtene

B. Kucharska [a] , J. Michalski [b] , A. Szyma[ngrave]ski [b] & J. [sgrave]viatek [a]

[a] Pedagogical University, Czestochowa, Poland

[b] Polytechnic University, Rzeszów, Poland

Version of record first published: 04 Jun 2010.

To cite this article: B. Kucharska , J. Michalski , A. Szyma[ngrave]ski & J. [sgrave]viatek (1993): Low-Frequency Dielectric Properties of Acenaphtene, Molecular Crystals and Liquid Crystals Science and Technology. Section A. Molecular Crystals and Liquid Crystals, 229:1, 221-223

To link to this article: http://dx.doi.org/10.1080/10587259308032200

Mol. Cryst. Liq. Cryst. 1993, Vol. 229, pp. 221–223
Reprints available directly from the publisher
Photocopying permitted by license only

Printed in the United States of America

LOW-FREQUENCY DIELECTRIC PROPERTIES OF ACENAPHTENE

B. KUCHARSKA, J. MICHALSKI*, A. SZYMAŃSKI*, J. ŚWIĄTEK
Pedagogical University, Częstochowa, Poland
* Polytechnic University, Rzeszów, Poland

Abstract Charge and discharge currents in acenaphtene have been measured by the time domain method.

INTRODUCTION

The electrical properties of organic materials have been investigated for many years because of their importance in biological systems. It is difficult to study dielectric phenomena in complicated organic materials so that some simple substances[1,2] are chosen as models for investigations.

TIME DOMAIN METHOD

The time domain method is one of the methods used to determine the dielectric parameters of materials.[1] In this method a single voltage pulse of specified amplitude, length and time interval is applied to the sample.

A general expression for the current density is given by

$$i_p(t) = \sigma_o E + \epsilon_o \delta E/\delta t + \delta P/\delta t \quad , \qquad (1)$$

where $E = V/d$, V - applied voltage, d - thickness, σ_o - direct current conductivity, P - sample polarization.

The value of σ_o can be find from the current at $t \to \infty$. Component $\delta E/\delta t$ disappears when a single voltage pulse is used and therefore, for longer times, only polarization change determines variation of the current.

Time evolution of the polarization current follows the equation

$$i(t) = \frac{A}{(\omega_p t)^n + (\omega_p t)^{1+m}} \quad . \qquad (2)$$

EXPERIMENT

In this paper the dielectric properties of polycrystals of acenaphtene (puriss., JEL. England) were measured using samples of about 40μm thickness at temperature 294K by the time domain method.

The polarization and depolarization current has been measured with sampling period 2ms, pulse width 20 sek., and voltage step 10 V.

RESULTS

The measured time dependence of polarization and depolarization currents is shown in Figure 1.

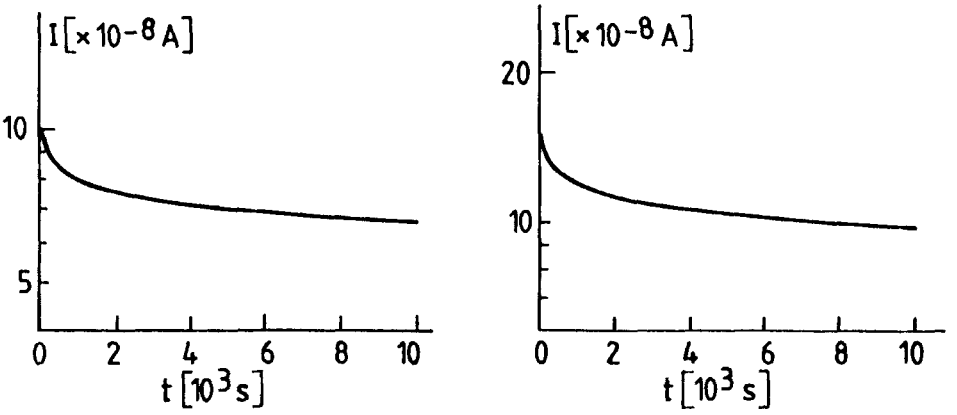

FIGURE 1 a) Polarization and b) depolarization current in acenaphtene; voltage step V = 10V.

After extrapolation of results to $t \to 0$ and $t \to \infty$, the experimental data were displayed in a log - log scale (Fig.2), giving parameters n = 0.84 and m = 0.54.

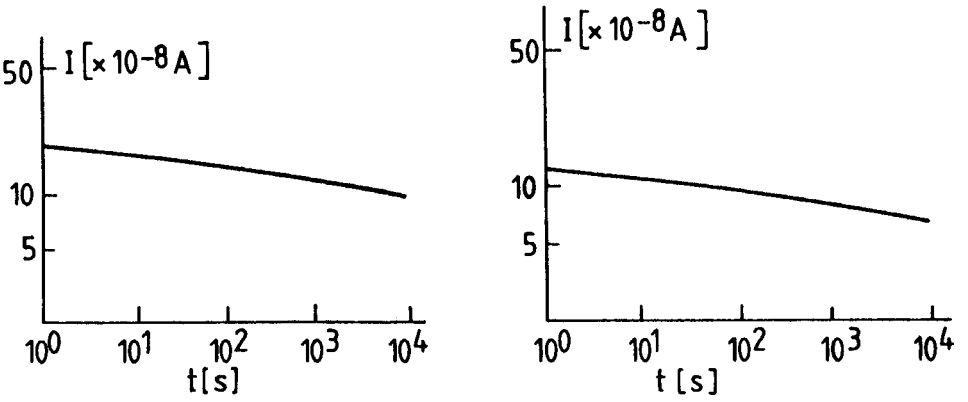

FIGURE 2 a) Polarization and b) depolarization current in acenaphtene, displayed in a log-log scale.

Smooth time dependence of the polarization and depolarization current in acenaphtene suggests volume homogenous polarization for used experimental conditions.

Improvements in the measurement program are continued to enable an extension of the data collection time and to obtain Fourier transform current time dependencies.[a]

REFERENCES

1. A. K. Jonscher, Dielectric relaxation in Solids (Chelsea Dielectric Press, London 1983).
2. G. W. Bąk, J. Phys. C: Solid State Phys., 21, (1988).
3. A. Szymański, W. Szymański, 1989 (unpublished).