Molecular Crystals and Liquid Crystals
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/gmcl16

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Version of record first published: 13 Dec 2006.

Mol. Cryst. Liq. Cryst., 1987, Vol. 146, pp. 321–324
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Printed in the United States of America

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(*Received July 23, 1986*)

Keywords: cholesteric liquid crystals, cholesterol esters, phase transitions, neutron radiation

INTRODUCTION

The influence of ionizing radiation on the mesogenic properties of cholesterogens has been studied by several authors.[1–6] The main conclusions of these works were:

1. The temperature of S-Ch transition and consequently the temperature of color response have been lowered after being irradiated linearly with an absorbed dose (and non-linearly with sufficiently high doses [6]) for all systems studied.
2. The above have been caused by products of radiolysis of cholesterogen which acts as a dopant of CLC.

The majority of these works were concerned with the influence of gamma-radiation on the solutions of mesogenic cholesteryl esters in organic solvents. In this paper, we present some interesting results of the preliminary studies on the effect of neutron radiation on the mesogenic properties of cholesteryl esters.

EXPERIMENTAL

The samples of mesogenic cholesteryl esters purified carefully by crystallization have been packed in polyethlene containers. As a neutron source, two generators ($E_n = 14.6$ and 18.6 MeV) and a converter of neutrons from reactor (continuous spectrum of energies over 0.5 MeV) have been utilized.

After irradiation in solid state, the temperatures of the phase transitions have been measured by means of the polarizing microscope with heating stage type PHMK. Additionally the parameters of color response have been measured by the method described elsewhere.[7] The accuracy of neutron beam was ± 20 per cent. The content of gamma radiation dose was lower than 30 per cent of total dose in the case of converter and lower than 6 per cent in the case of generators. The accuracy of measurements was ± 0.2 K.

RESULTS AND CONCLUSIONS

At first the typical mixture of cholesteryl esters: cholesteryl oleyl carbonate, cholesteryl nonanoate and cholesteryl chloride (60:32:8 per cent by weight) have been studied. The results of measurements are plotted in Figure 1. The most interesting observation as follows: in the studied range of absorbed doses the temperature of S-Ch transition was raised nearly with absorbed dose.

To confirm this result, further studies have been carried out for the individual mesogens. Three cholesteryl esters have been studied—cholesteryl propionate, cholesteryl butyrate and cholesteryl nonanoate.

The results are plotted in Figure 2. As one can see the temperatures of S-Ch and Ch-I transitions have risen for small doses reached their maximum values at ca 120 Krads and then decreased. The melting point did not change.

For the cholesteryl propionate and cholesteryl butyrate no changes in transition temperatures have been observed for small doses and their very smooth lowering for high doses.

The observed changes of the transition temperatures have been small, often in the limits of measurement accuracy, so it was difficult to say anything about energy of neutron effect. The measurements for very high doses (order 1 Mrad) were time-expensive and therefore difficult to be carried out.

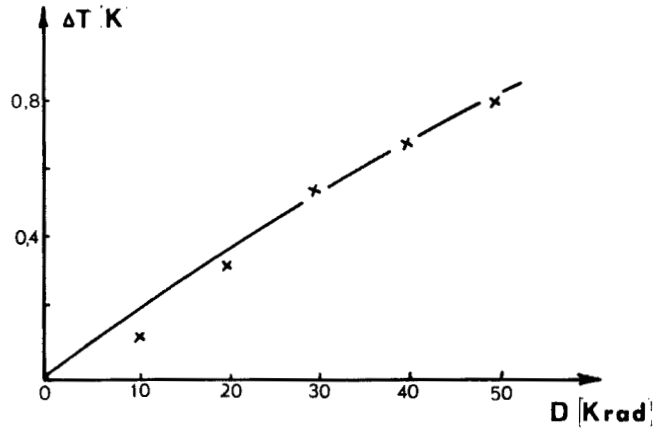

FIGURE 1 The temperature shift of the color response of the mixture of cholesteryl oleyl carbonate, cholesteryl nonanoate and cholesteryl chloride (60:32:8) irradiated by the neutron beam (14,6 MeV).

The main results have been confirmed, however. The phase transition temperatures, especially S-Ch were non-linear. It seems that for cholesteryl esters with a short alkyl chain this effect was less pronounced.

So, there are probably two concurrent effects of neutron radiation on mesogenic cholesteryl esters. The first is a well-known decrease

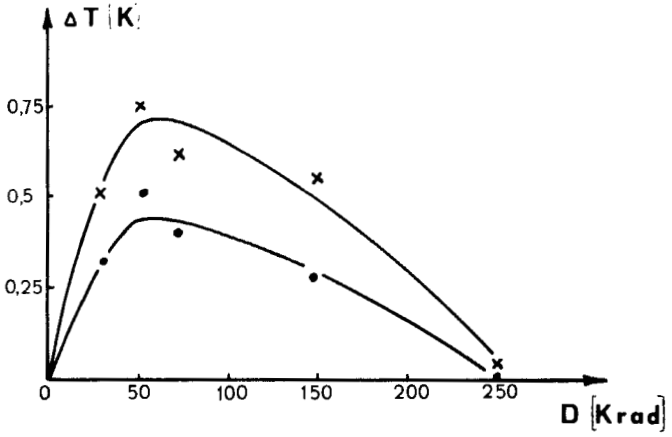

FIGURE 2 The temperature shift of the S-Ch (crosses) and Ch-I (dots) phase transitions of cholesteryl nonanoate irradiated by the neutron beam (18,6 MeV).

in phase transition temperatures, caused by the radiolysis products which is principal for sufficiently high doses. The second is a very interesting effect of improvement in the temperature stability of mesophase which is principal for lower doses.

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Summary The rise of the temperatures of S-Ch and Ch-I phase transitions of cholesteryl nonanoate irradiated by the neutron beam has been observed for absorbed doses order 10 ÷ 100 Krad. For the sufficiently high doses, these temperatures have been decreased.