Application News

SHIMADZU

THERMAL ANALYSIS T96

Measurement of Phase Transitions of Liquid Crystals by DSC

Liquid crystals are materials to be liquefied in unique configurations in certain temperature ranges, and have both crystal and liquid properties.
Several hundreds of materials displaying the liquid crystal property have already been discovered, such as P-azoxy benzoic acid ethyl, oleic acid sodium and others. In particular, those having electric field responsibilities are often used as materials for devices with thin displays, such as clocks and calculators.
Recently, developments of liquid crystal materials have aimed at attaining higher qualities of liquid crystal displays. Additionally, improvements can be seen in characteristics such as those of SBE liquid crystals, in which liquid crystal molecules are oriented torsionally at 180 degrees or higher, ferroelectric liquid crystals that present high responsibilities, and so on in addition to conventional nematic liquid crystals and twisted nematic liquid crystals.
The temperature range in which a substance presents the liquid crystal property may be easily determined by a differential scanning calorimeter (DSC).

Measurement of binary liquid crystals

In liquid crystals, similar ones are mixed with each other, and the transition temperature varies with the mixing rate in accordance with the change in phase from crystal to liquid crystal.
Figure 1 shows a phase diagram where two kinds of liquid crystals (azoxydiphenetole (ADP) and cholesteryl benzoate (CB)) were mixed at several different rates and measured by DSC.
This system consisted of several phases: crystal, nematic liquid crystal, isotropic liquid and two metastables. In the case of ADP and CB mixed at rate of 35:65, for example, transitions were observed from crystal to metastable at 109˚C, from metastable to nematic liquid crystal at 123˚C and from nematic liquid crystal to liquid at 161˚C.

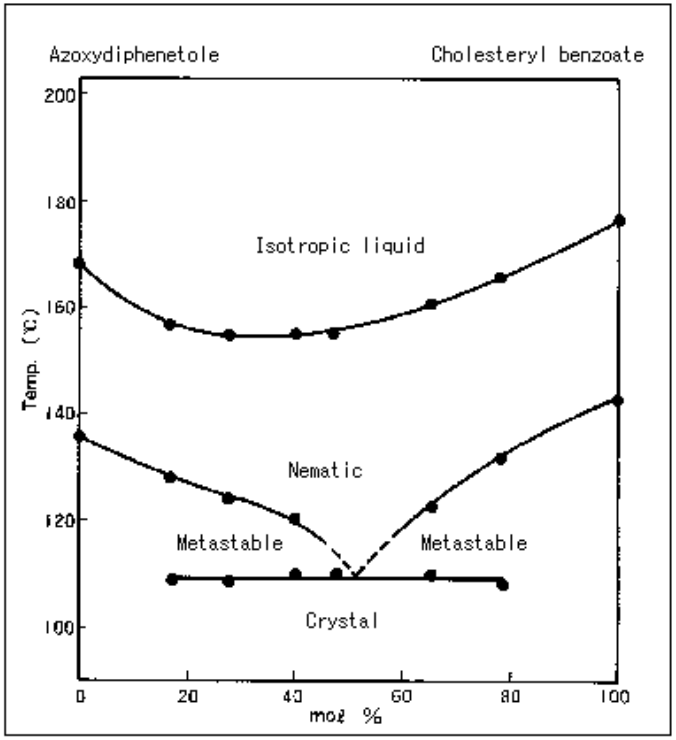

Fig. 1
Phase diagram of azoxydiphenetole-cholesteryl benzoate system

Figures 2 and 3 show respective DSC curves of azoxydiphenetole and cholesteryl benzoate, respectively. Figures 4-7 show how the two components were mixed at several different rates.

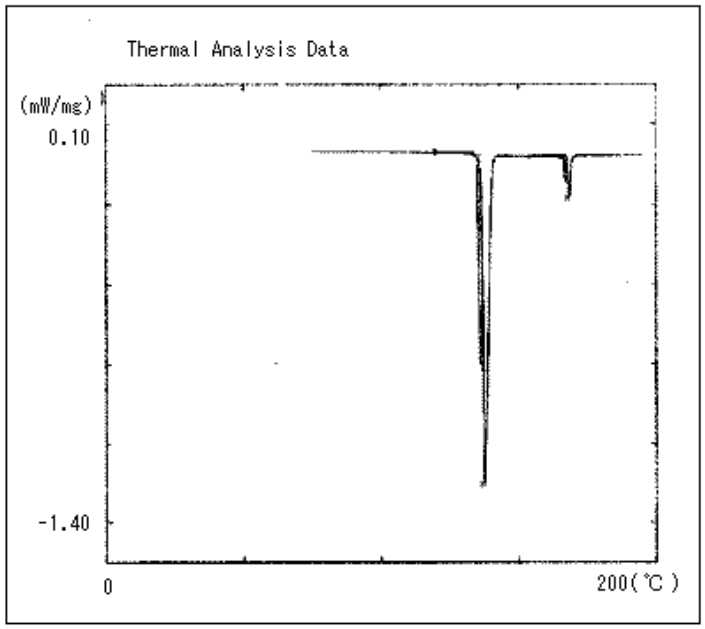

Fig. 2 Azoxydiphenetole (ADP)

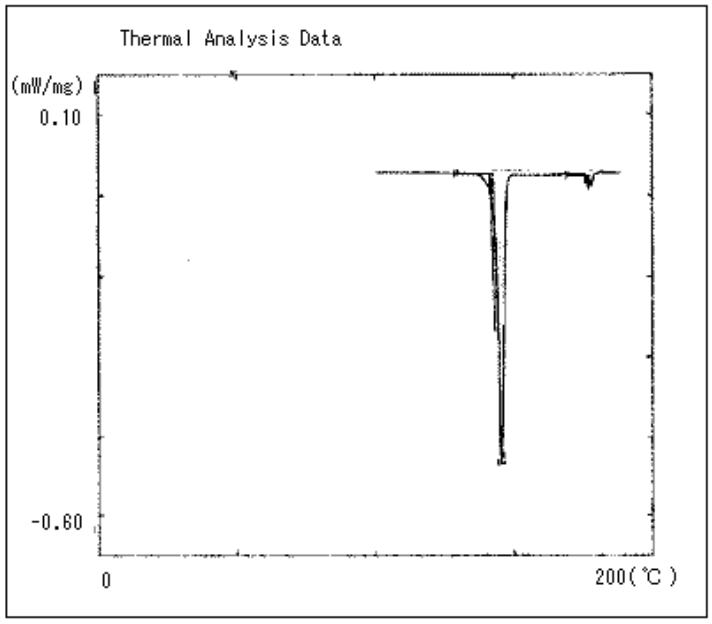

Fig. 3 Cholesteryl Benzoate (CB)

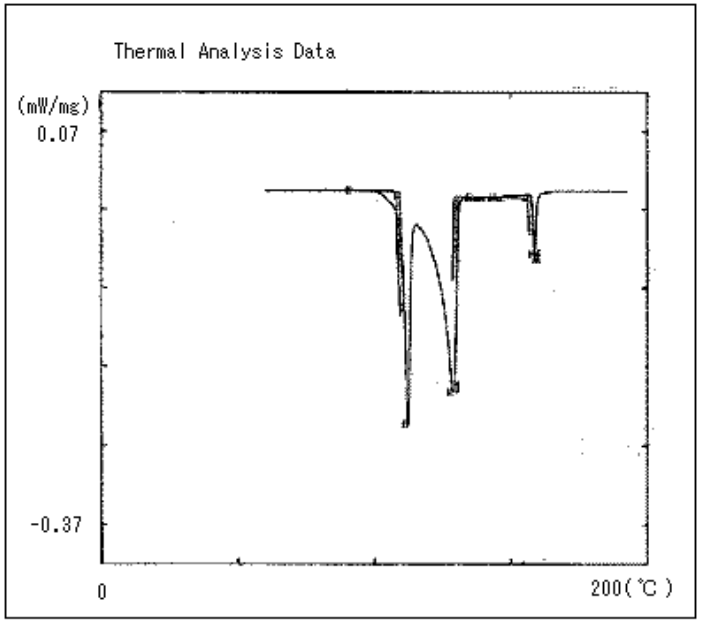

Fig. 4 ADP83%, CB17%

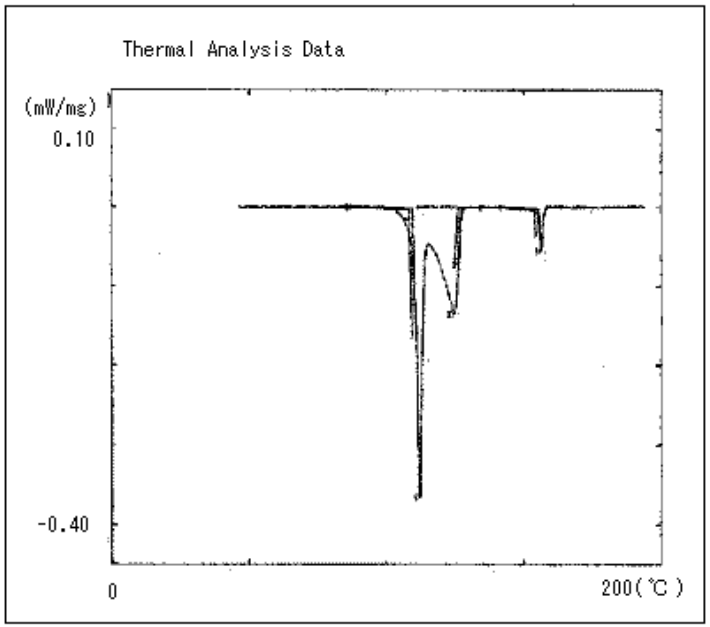

Fig. 5 ADP72%, CB28%

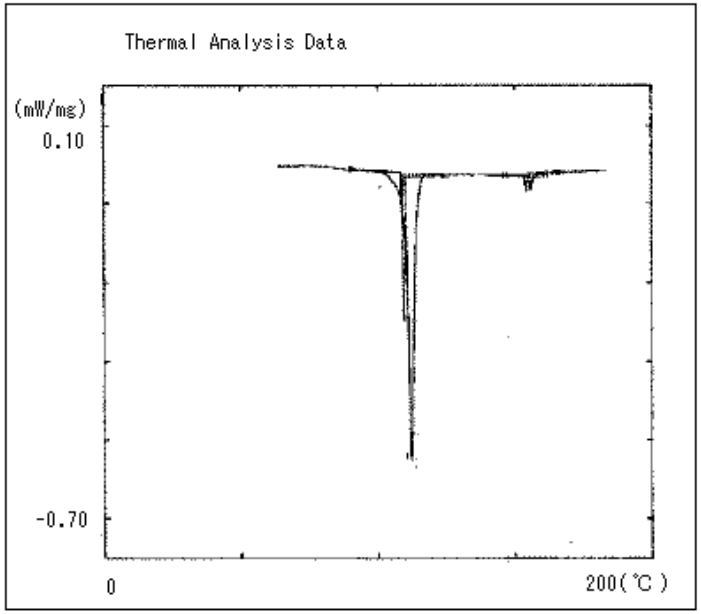

Fig. 6 ADP53%, CB47%

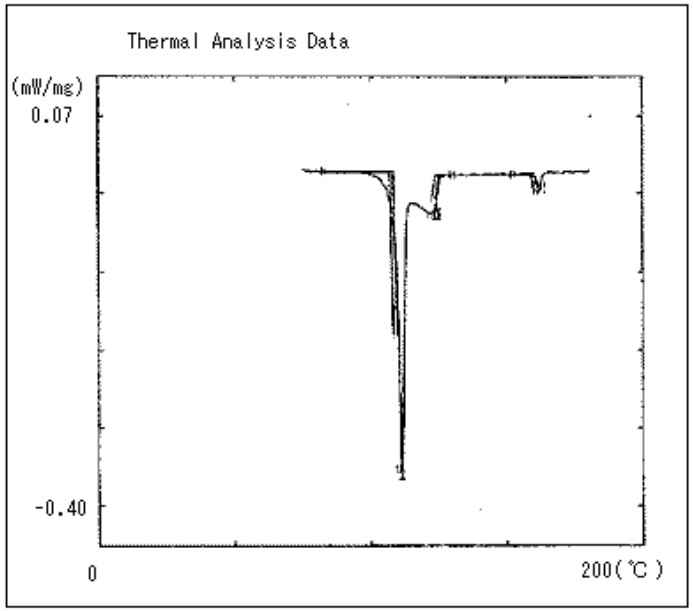

Fig. 7 ADP35%, CB65%

* Please be advised that data obtained before the implementation of the current Weights and Measures Law may be presented in terms of gravimetric unit.

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