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COMMUNICATION

Di-ethyl-*p*-terphenyl-4, 4″-carboxylate의 Smectic *E* Phase 보다 낮은온도에서의 Extra의 Phase

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An Extra Phase Below the Smectic Modificatation of Di-ethyl-*p*-terphenyl-4, 4″-carboxylate

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The studies of liquid crystals are generating more and more interests because the natural curiosity of the mesomorphic phenomenon and the realization of its future industrial applications. Liquid crystals with different smectic modifications have drawn a lot of attention because of different degrees of order existing in their structures. Among various smectic phases, smectic *E* possesses a high degree of order. Compounds with smectic *E* phase such as di-*n*-propyl-*p*-terphenyl-4,4″-carboxylate (DPTC) were studied[1,2]. We would like to report here some observations of the homologue of DPTC, namely, that of di-ethyl-*p*-terphenyl-4, 4″-carboxylate (DETC) which also exhibits the relatively rare smectic *E* modification.

From Diele *et al.*[2], the transition temperatures of DETC was reported in °C as

$$\text{Solid} \overset{173}{\longleftrightarrow} S_E \overset{188.5}{\longleftrightarrow} S_A \overset{259.0}{\longleftrightarrow} \text{Isotropic}$$

In our studies we used pulverized single crystals of DETC grown from purified sample with dioxane as solvent. The extra phase was indicated first by the DTA thermograph (*Fig.* 1). It showed a distinct transition at 154 °C besides those at 175, 189 and 261 °C which correspond to the values reported by Diele *et al.*[2] Microscopic observation also showed that there is a

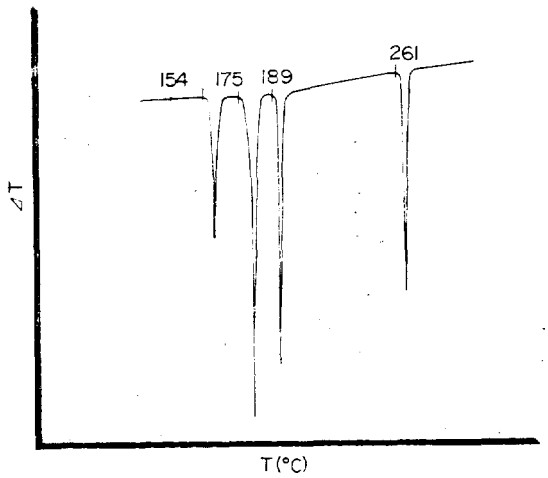

Fig. 1. The heating differential thermal analysis (DTA) graph for DETC.

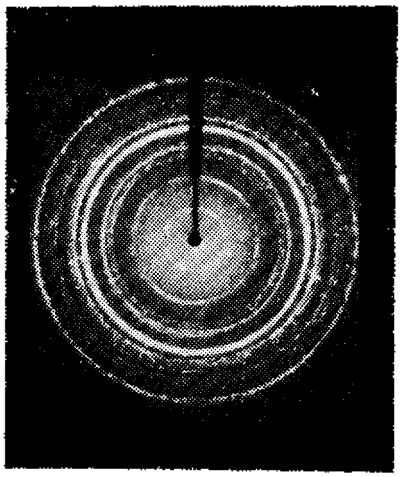

Fig. 2. X-ray diffraction pattern for a room temperature powder sample of DETC.

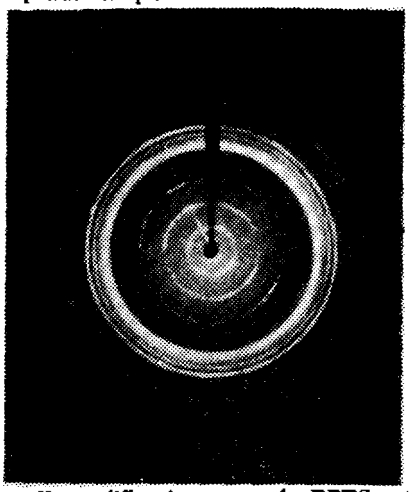

Fig. 3. X-ray diffraction pattern for DETC at 155°C.

change in the texture of the sample at 154 °C. In addition, the X-ray diffraction pattern of a powder sample at room temperature (*Fig.* 2) showed unequivocal difference from that of the same sample at 155 °C(*Fig.* 3). A cooling DTA thermograph for the transition at 154°C could not be reproduced with consistency due to extensive supercooling of the compound. However, we could repeat our X-ray diffraction patterns through drastic cooling. This may explain the possibility that Diele *et al.* did not observe the phase transition at 154 °C if the sample they

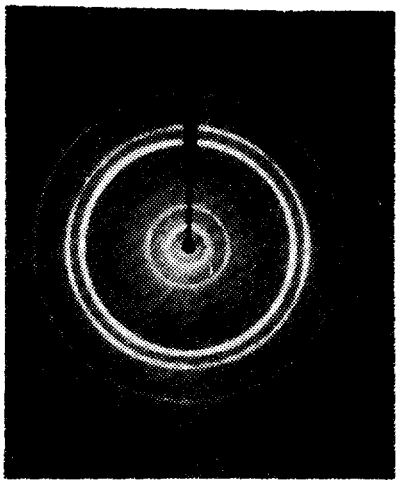

Fig. 4. X-ray diffraction pattern for DETC at smectic *E* phase termperature (175 °C).

used was still at the supercooling stage.

A comparison of the X-ray diffraction patterns shows that DETC at 155 °C (*Fig.* 3) is quite similar to that of the smectic *E* phase (*Fig.* 4) which possesses an apparent 3-dimensional order[1], particularly, where the outer rings begin to merge together and become grossly diffused. This is indeed a big contrast to the diffraction pattern of the extra phase we observed below 154 °C. By crystallographic study of DPTC, it was found that the end groups of the molecule were highly anisotropic even at room temperature as crystalline solid[3]. Moreover, the diffraction pattern of solid DPTC[1] was more clearly defined and not as diffused as that of DETC at 155 °C (*Fig.* 3). Preliminary indication is that the phase existing below the smectic *E* phase and above 154 °C could be a borderline metastable smectic *E*-like solid.

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