DTA and Dielectric Studies of a Substance with the Nematic, Smectic A, and Smectic C Polymorphism at Ambient and Elevated Pressures

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For the first time the low frequency relaxation process in two smectic phases (smectic A and smectic C) was studied at elevated pressures with the aid of DTA and dielectric spectroscopy. The substance studied, 2-(4-hexyloxyphenyl)-5-octyl-pyrimidine (6OPB8 in short) exhibits the nematic (N) – S_A – S_C phase sequence. The *p-T* phase diagram was established with DTA. However, the S_A – S_C transition was not observed in the DTA, but could be detected by dielectric relaxation measurements. The dielectric relaxation time measured as function of temperature and pressure, $\tau_{\|}(p,T)$, enabled us to calculate the activation volume, $\Delta^{\#}V = RT(\partial \ln \tau/\partial p)_T$, and activation enthalpy, $\Delta^{\#}H = R(\partial \ln \tau/\partial T^{-1})_p$. It was found that $\Delta^{\#}V(S_A) > \Delta^{\#}V(S_C)$ and $\Delta^{\#}H(N) \gg \Delta^{\#}H(S_A) > \Delta^{\#}H(S_C)$, indicating that the molecular rotations around the short axes are more feasible in the tilted S_C than in the orthogonal S_A phase.

Key words: Liquid Crystal; Dielectric Relaxation; *p-T* Phase Diagram; High Pressures.