Drastic change of mesomorphism induced by the fluorination of peripherally attached phenyl groups in triphenylene mesogens

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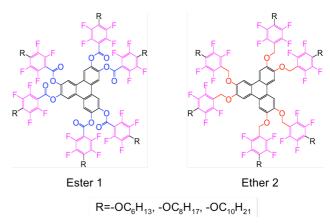
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Intermolecular specific interactions are interesting tools for controlling molecular orders in both time-averaged and dynamical points of view. Discotic columnar mesophase has been extensively studied as a new type of organic semiconductors and this category of molecular materials is featured by the self-assembling nature of molecules by way of its dynamical situations of molecular aggregations. In these years, we have studied on fluorination effect of mesogenic molecules on semiconducting as well as mesomorphic properties for triphenylene mesogens and it was found that the perfluoroalkylation of the peripheral chains in hexaalkoxytriphenylenes leads to stabilisation of hexagonal columnar (Col_h) mesophase [1] and to strong tendency toward homeotropic alignment for a variety of substrates [2].

In this communication, triphenylene mesogens possessing fluorinated phenyl groups which are connected with the central triphenylene core by an ester (1) and ether (2) linkages were compared on the mesomorphism. Also the carrier mobility was evaluated by Time-Of-Flight (TOF) technique and giving an insight for the molecular order in the Col_h mesophase.

For the ester derivatives **1**, it was found the fluorination of the peripheral phenyl groups in hexaalkoxybenzoyloxy



mesogens leads to a drastic enhancement of thermal stability of columnar phases [3] and furthermore, the position of fluorination attached to the phenyl group strongly affect the mesomorphism to give the extremely high stability of columnar phases over 400 °C [4]. On the other hand, the ether derivatives **2** exhibit a Col_h mesophase with the lower clearing points and the larger transition enthalpies. The XRD patterns of **2** exhibit no distinct reflection corresponding to the intracolumnar stacking periodicity, whilst a relatively sharp reflection of the stacking order could be observed for **1**. Furthermore, the observed drift mobility of positive carriers in the Col_h mesophase is on the order of 10^{-2} cm² V⁻¹ s⁻¹ for all homologues of **2** with the relatively weak temperature dependence, which is higher than that of 1 (~ 10^{-3} cm² V⁻¹ s⁻¹). Fluorination of the peripheral phenyl groups in triphenylene mesogens leads to the enhancement of columnar mesomorphism probably due to arising strong interactions among the peripheral part of molecule. Such mesophase behaviour implies the peripheral phenyl groups is involved in the rigid core part of molecule.

References

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