Five layer super-lattice structure in binary mixtures of ferroelectric and antiferroelectric liquid crystals

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Emergence of subphases having super-lattice structures with different periodicities other than 3 layer and 4 layer has been theoretically predicted [1-2] and experimentally observed [3-5], however, it was not widely accepted. In this paper, we shall report on the emergence of a biaxial subphase of 5 layer super-lattice structure, $q_T = 3/5$, in two binary systems with usual ordinary and unusual extraordinary phase sequences, observed in the E-T phase diagrams constructed by electric-field-induced birefringence measurements. Here, $q_T$ is defined by, $q_T = [F]/[F]+[A]$, where, $[F]$ and $[A]$ refer to ferroelectric and antiferroelectric orderings respectively in a unit cell of the super-lattice structure. Binary mixtures of MHPOCBC and MHPOOCBC which show usual ordinary phase sequence of - SmC\textsubscript{A}$^*$ - SmC\textsuperscript{*} - SmC\textsubscript{a}$^*$ - SmA were used in different MHPOOCBC wt\%, in the range of 63.3 wt\% - 65.5 wt\%. The other binary system studied consists of 10OHF and C11 showed SmC\textsuperscript{*} - SmC\textsubscript{A}$^*$ - SmC\textsubscript{a}$^*$ - SmA unusual reversed phase sequence in heating. In both systems emergence of a biaxial subphase in a very narrow temperature range below SmC\textsubscript{a}$^*$ in the E-T phase diagram similar to a ferrielectric phase was identified suggesting 5 layer super-lattice structure.

Keywords: super-lattice structure, ferroelectric, antiferroelectric, five layer