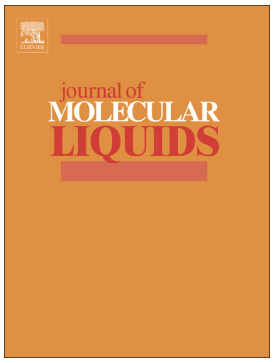


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Kartick Ch. Dey, Pradip Kumar Mandal

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# Formulation of a binary eutectic antiferroelectric liquid crystal mixture: comparison of dielectric and electro-optic properties with the pure compounds

Kartick Ch. Dey[1] and Pradip Kumar Mandal[2#]
[1]Department of Physics, Achrya Prafulla Chandra Roy Government College, Matigara, Siliguri–734010, West Bengal, India
[2]Department of Physics, University of North Bengal, Siliguri – 734013, West Bengal, India
[#]*Corresponding author email:* mandal_pradip@yahoo.com

**Abstract:** Two antiferroelectric liquid crystals [$C_3F_7$.$CH_2O$.$C_6H_{12}$.O.Ph.COO.Ph.Ph.COO.CH*($CH_3$)$C_6H_{13}$] and [$C_3F_7$.$CH_2O$.$C_6H_{12}$.O.Ph($F_2$).COO.Ph.Ph.COO.CH*($CH_3$)$C_6H_{13}$] are mixed in varying wt.% to investigate the change of melting point, phase sequence and other properties. The eutectic mixture is obtained at 50 wt.% of each. It shows the same phase sequence as that of pure compounds (Cr–Sm$C_A$*–SmC*–SmA*–Iso) but with increased range of Sm$C_A$* phase which supercools till -8$^o$C. The critical frequencies of all the collective relaxation modes ($P_L$, $P_H$, GM and SM) lie in between those of the pure compounds. $P_L$ and SM critical frequencies are not proportional to the concentration of pure compounds but for $P_H$ and GM they are almost proportional. The critical field for suppression of the $P_L$ mode is increased significantly in the mixture. The GM mode dielectric increment of the eutectic mixture decreases substantially in comparison to pure compounds. Hereditary mode is observed to penetrate almost 5.0 $^o$C inside the Sm$C_A$* phase. The critical field for suppression of GM is observed to increase. No domain mode is detected in the mixture unlike in the pure compounds. SmC*–SmA* transition temperature is found to increase linearly with bias field and has been explained using Landau model. Spontaneous polarization remains slightly less than the pure compounds. It shows switching time of about a few hundred microseconds which is intermediate between those of the pure compounds. The rotational viscosity is increased slightly but the activation energy is decreased compared to the pure compounds. Paraelectric to ferroelectric transition of the mixture is tricritical in nature like the pure compounds.

**Keywords:** eutectic binary mixture; dielectric increment; critical field and critical frequency; spontaneous polarization; switching time; activation energy