Reorientation effect and electrical current in a weakly anchored nematic cell

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A nematic cell subjected to a large electric field undergoes a molecular reorientation that affects the electrical current flowing through it. To analytically establish the dependence of the current on the applied voltage, the cell is considered as a parallel of a resistance, $R(t)$, and a capacitance, $C(t)$, that are connected with the nematic director profile. This profile is determined in the quasi-static regime in which the nematic orientation follows the time variation of the external field, normal to the cell plates, without delay. The analysis, performed for a weakly anchored cell, shows that the current presents a peak when the applied voltage overcomes the threshold voltage for the transition of Fréedericksz, at a critical time t^*, as in the case of strong anchoring (1). For large voltages, $R(t) \to R_{\|}$ and $C(t) \to C_{\|}$, where $\|$ refers to the nematic director. We show that, for large enough time, i.e., $t >> t^*$, it is possible to connect the measured current with the extrapolation length characterizing the sample by means of simple analytical expressions. This connection can be used to experimentally estimate the anchoring energy by means of current measurements.

(1) R. Atasiei, A. L. Alexe-Ionescu, C. Dascalu, J. C. Dias, and R. Teixeira de Souza *Physics Letters A* **2008**, *372*, 6116.