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Effective Conductivity due to Continuous Polarization Reorientation in Fluid Ferroelectrics[1] JOSEPH MACLENNAN, YONGQIANG SHEN, TAO GONG, RENFAN SHAO, EVA KORBLOVA, DAVID WALBA, NOEL CLARK, Liquid Crystal Materials Research Center, University of Colorado at Boulder — In crystal ferroelectrics, the macroscopic polarization density **P** is stabilized to a set of discrete orientations by the underlying lattice, and ferroelectricity characterized by field-induced switching of **P** between these stable states. Fluid ferroelectrics exhibit **P** with no energy barriers to its reorientation. As a result, **P** can respond to applied electric field in a continuous fashion. We show here that, due to the reorientation of **P**, an otherwise insulating fluid ferroelectric behaves electrically as a resistive medium, with conductivity in the semiconducting range. Measurements of cell dynamics are reported for the $SmAP_F$ material W623, a bent-core liquid crystal (LC) with large macroscopic polarization that we find to exhibit nearly ideal field-induced block polarization reorientation. We have investigated theoretically the dynamic behavior of block polarization in the $SmAP_F$ phase, finding that a reorienting LC polarization block behaves electrically as a resistor. Experimental studies of W623 confirm this behavior, revealing the low resistance of the block-reorienting LC and the corresponding characteristic flat-topped step in the current response.

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