

## Shear-mode piezoelectric current generation and oscillatory rheology in ferroelectric nematics

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Piezoelectricity is defined as an electromechanical coupling, where electric polarization is generated as a linear function of mechanical stress. This phenomenon was originally observed in solid crystals and has widespread applications from sensors to actuators or in gas lighters. Converse piezoelectricity was recently discovered in three-dimensionally fluidic ferroelectric nematic liquid crystals [1,2]. Direct piezoelectric type signals have only been measured qualitatively, as viscous mechano-electric response [3]. Here we present quantitative measurements of periodic shear-generated electric currents for the two prototype ferroelectric nematic compounds RM734 and DIO. Additional oscillatory rheology measurements were carried out to shed light on the different characters of the antiferroelectric intermediate and ferroelectric nematic phases and their potential viscoelastic behavior, which we also compare to rotational mode viscosity measurements [4]. From temperature, frequency and deformation amplitude dependent results of the current signals together with the viscoelastic properties determined by oscillatory rheometry, we were able to determine the shear-related direct piezoelectric coupling constants. These values are similar for both studied materials and are compared to results of previous converse piezoelectric measurements. We also propose a physical mechanism related to flow alignment of ferroelectric polarization leading to the direct piezoelectric signals (see Figure 1).

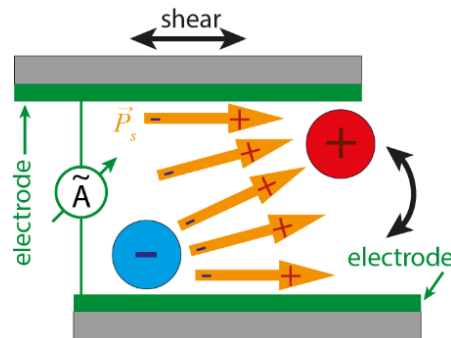


Figure 1. A possible scenario for electrical current generation by periodic shear deformation of a ferroelectric nematic fluid.

### References

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