Vibration Dynamics of Ferroelectric Fibres in Oscillating Electric Fields

A. Jarosik[1*], H. Nádasi[1], A. Eremin[1]

[1] Department of Nonlinear Phenomena, Institute of Physics, Otto von Guericke University, Magdeburg 39106, Germany
[*] Author for Correspondence: alexander.jarosik@ovgu.de

The recently discovered ferroelectric nematic (N_F) liquid crystal phase marks a major advance in the field of liquid crystals. With its pronounced polarisation and remarkable structural flexibility, the N_F phase opens new avenues for applications ranging from electromechanical actuation to nonlinear optics and energy harvesting.

Among its most striking features is the spontaneous formation of freely suspended ferroelectric filaments [1, 2]. In these structures, the electric polarisation aligns along the filament axis and suppresses surface instabilities, thereby stabilising the cylindrical shape of the fluid.

A key consequence of the coupling between the electric field and the spontaneous polarisation is the field-driven modulation of filament tension. This gives rise to a rich vibrational behaviour under alternating electric fields, ranging from longitudinal thickness variations to transverse, multimodal oscillations (Fig. 1). Here, we present a detailed characterisation of this dynamic response in the frequency–amplitude domain, and introduce a qualitative model that captures the underlying mechanisms of the observed phenomena.

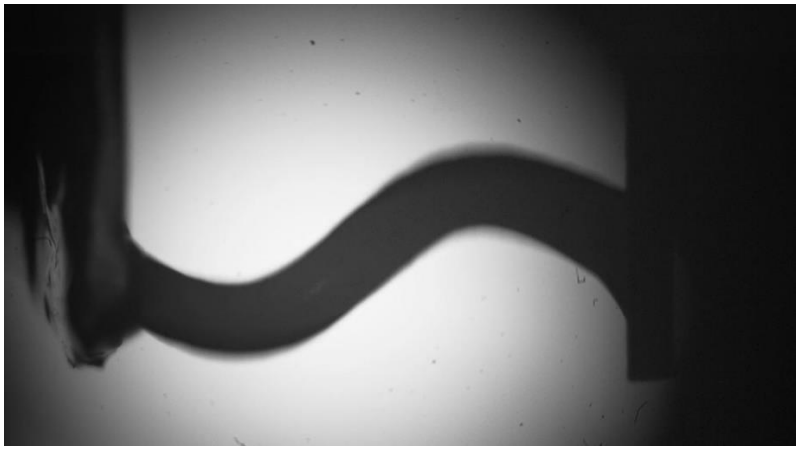

Fig. 1: Oscillating horizontal ferroelectric nematic fiber

References

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