Smectic C* layer buckling and fast electro-optics of a LC confined in anodic aluminium oxide nanochannels

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The ferroelectric liquid crystal 2MBOCBC confined inside the nanochannels of anodic aluminium oxide (AAO) is investigated concerning its structural and electro-optical properties and their change as a function of temperature.[1] The AAO nanochannels of different pore diameters from 20 nm up to 42 nm are coated with a polymer in order to force a tangential alignment of the liquid crystal molecules at the channel walls.

Neutron diffraction experiments reveal a fully reversible, hysteresis-free smectic C* layer buckling towards a chevron-like structure during the temperature course in AAO membranes with 42 nm channel diameter (see Figure 1). This chevron formation is accompanied by a drastic reduction of the linear electro-optic response, as a result of the structural reorgani-sation of the smectic layers.

The phason relaxation frequency, investigated by electro-optical measurements, is found to be two orders of magnitude higher in the nanoconfinement compared to the bulk liquid crystal. It possesses a temperature behaviour following an Arrhenius law (see Figure 2) and its magnitude varies proportionally to the inverse of the squared channel radius.

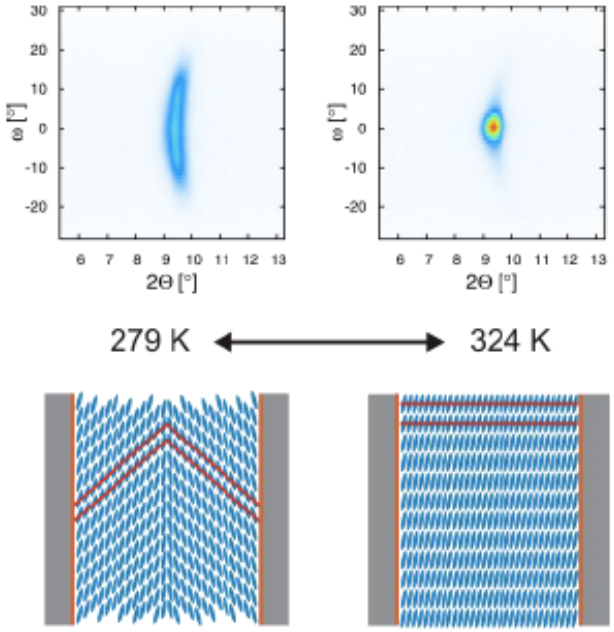

Figure 1: Neutron diffraction data show the reversible formation of a chevron-like smectic layer structure.

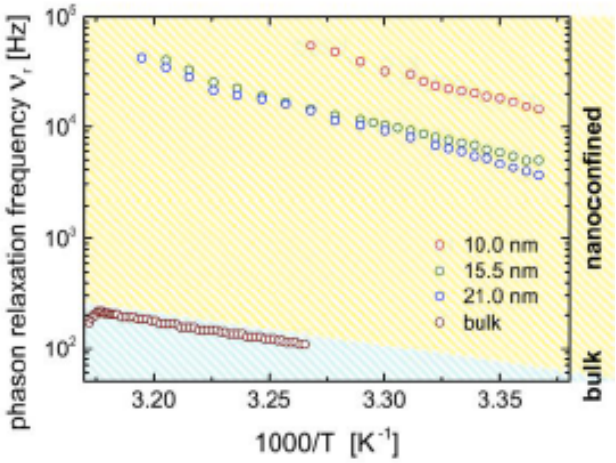

Figure 2: Arrhenius-type temperature behaviour of the phason relaxation frequency of the bulk and the nanoconfined liquid crystal.

References

[1] M. Busch, A. V. Kityk, W. Piecek, T. Hofmann, D. Wallacher, S. Całus, P. Kula, M. Steinhart, M. Eich and P. Huber, Nanoscale **9**, 19086 (2017)

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