Transition from a collective to a progressive mode of director reorientation in a side-chain nematic polymer

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Recent NMR measurements [1] of the dynamics of confined nematics raised the question of the universality of the classical picture of field-induced molecular reorientation [2], according to which the applied magnetic field induces a *collective* (either homogeneous or non-homogeneous) reorientation of the molecules to the field direction (for $\Delta\chi > 0$). More recently, an interpretation of the NMR data was offered [3] that unravelled a new reorientation mode that nucleates in the vicinity of local non-homogeneities of the director field (e.g. topological defects or boundary misalignments) and then progresses in time throughout the sample. In practice, this *progressive* mode of reorientation may co-exist and compete with the collective modes originated in the long wavelength thermal fluctuations of the director orientation. The collective modes are usually dominant, which explains why the progressive mode has only recently been recognized. In this work, we report on the first observation of the two reorientation modes in the same sample but different temperature regions of the nematic phase of a side-chain polymer. In the high temperature region we observe the usual collective mode of reorientation; in the low temperature region we observe the progressive mode. Collective and progressive modes have distinct NMR signatures and may be recognized rather easily. The NMR data for both modes are well described by computer simulations based on the Leslie-Ericksen theory. The transition from one mode to the other one is discussed.

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