REORDERING DYNAMICS OF NEMATIC MBBA FILM PROBED BY LASER INDUCED DYNAMIC GRATING

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We report time profiles of transient diffraction signal created by crossed beam excitation of nematic MBBA film of 170 ㎛ thickness. With the excitation energy of about 2.5 J/cm^2, the signal generally consists of at least three distinguishable components in the time range of submicroseconds to milliseconds. The fastest component rises within the time resolution of the experiments (~20 ns) and decays within a few tens of μs. This component exhibits the probe polarization dependency that decreases as the temperature approaches the nematic ↔ isotropic transition point (46.7 ℃). This behavior suggests that the reorientational rotation of MBBA molecule takes place in this time scale. Both the middle component (in the submicrosecond time scale) and the slowest component (in the millisecond time scale) of the diffraction signal display generally an exponential rise followed by an exponential decay. As the temperature approaches the nematic ↔ isotropic transition point, the slowest component becomes dominated. We interpret these observations with a picture in which reordering dynamics takes place in two directions; the reordering towards the sample walls (the middle components) and the reordering along the wave vector of the grating (the slow components). The former reordering should be less sensitive with the temperature while the latter should be opposite. Near the nematic ↔ isotropic transition point, the slow component induces multiple order diffractions as the grating shape deviates from the sinusoidality. When the time evolution of the grating shape is investigated using the relative intensities of the multiple order diffractions, the propagation or the oscillation of the ordering (or disordering) along the wave vector that is induced by reordering torque can be identified.