Imaging FT-IR spectroscopy for molecular orientation of the disclinations generated in the nematic cell

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The molecular orientation of disclinations in nematic liquid crystal (LC) has been investigated by imaging microscopic polarized infrared spectroscopy. The in-plane orientation and order parameter for each region has been determined by the comparison of band intensity for parallel and perpendicular vibration modes with respect to the molecular axis.

The 5CB and CaF_2 plates were used for nematic LC and infrared transmissive substrates of the sandwich cell, respectively. The FT-IR imaging were measured by FTS-7000 spectrometer and UMA600 microscope unit equipped with an imaging FPA (64x64) detector. The spatial resolution of the pixels in the map is 5.5 micro-meters.

Figure 1 shows the imaging map of polarized FT-IR spectra for intensity of the band at 2226 cm^{-1}. This band is assignable to the CN stretching mode, which transition moment is parallel to the long axis of the 5CB molecule. The intensity change of this band indicates by color; the LC molecule orients parallel to the direction of the infrared polarizer in the red area in this map. The disclinations are discriminated and classified by the comparison of polarized band intensity of CN and CH stretching modes. A disclination was characterized to the wedge disclination of strength -2π and +2π. The determination of vertical molecular orientation around the disclinations will also be discussed by imaging data for intensity of the bands.

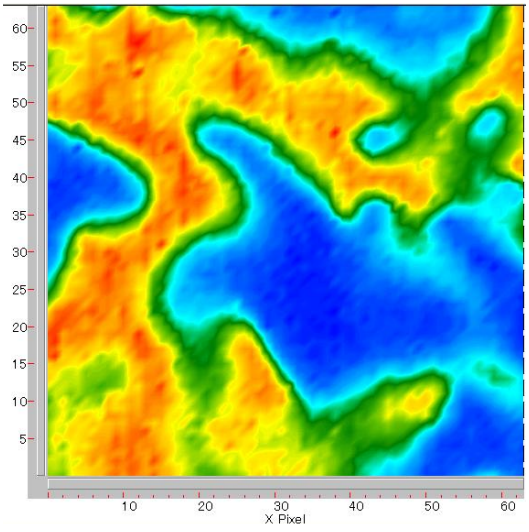

Fig 1. Imaging map for intensity of the CN stretching band.