**Experimental Details:**

**Small-angle X-ray scattering (SAXS)**

Scattering measurements were performed on the small-angle scattering instrument at SAGA synchrotron faculties (Synchrotron SAGA, Tosu, Kyushu, Japan) and in a Brucker nanostar SAXS machine in the University of Kyushu (Onojo Campus). The LC mixtures were introduced in a house lab cell. The available scattering vector $q$ range was between $1.0 \times 10^{-2}$ nm$^{-1}$ and 1.571 nm$^{-1}$ for SAGA SAXS and between 1.0 $\times 10^{-2}$ nm$^{-1}$ and 0.23 nm$^{-1}$ for the lab SAXS machine in the University of Kyushu respectively. This scattering vector $q$ is calculated by the following equation:

$$q = \frac{4\pi \sin \theta}{\lambda}$$

where $2\theta$ is the scattering angle and $\lambda$ is the wavelength ($\lambda=1.418$ Å) for both spectrometers. Several successive frames of 1800s each were recorded for each sample. A check for radiation damage or sample evolution was performed and no difference between frames was found unless otherwise specified. Each frame-averaged scattering spectrum was corrected for the detector response and scaled to the transmitted intensity, using the scattering intensity from a reference glassy carbon sample integrated over a given angular range. Standard deviations of each measurement were computed as the square root of the number of detected photons.

**Small-angle X-ray scattering (SAXS)**

Fourier transform infrared (FTIR) measurements in the range 650-4000 cm$^{-1}$, were recorded using a Thermo Nicolet 6700 FT spectrometer equipped with a Deuterated Triglycine Sulfate (DTGS) detector and a Nicolet Continium microscope. The LC mixtures were spread over an ZnSe window of the microscope. The analyzed sample area was a square of side 100 μm chosen under the microscope 15X Infinity Reflexchromat objective. The analyses were performed in transmission mode and each spectrum was the average of 256 scans collected at 1 cm$^{-1}$ resolution.
Figure S1: Chemical structure of the pentaethylene glycol monododecyl ether nonionic surfactant, abbreviated as C$_{12}$E$_{5}$.
Figure S2: Temperature-Concentration phase diagrams of C_{12}E_{5}-H_{2}O surfactant-water system. L_1 and L_2 correspond to a spherical and reverse micelle phases whereas H_1, V_1 and L_α refer to hexagonal, cubic and lamellar (self-assembled) phases.
Figure S3: Pictures of the prepared samples obtained by mixing niobate nanosheets at a concentration of 20 g/L (a) and nonionic surfactants at a mass fraction of 0.15 (b), 0.25 (c), and 0.4 (d).
Figure S4: Symmetric and asymmetric CH$_2$ stretching bands whose wave numbers indicate the presence of disorder / order in the alkyl chains. These two CH$_2$ stretching bands appear at wave numbers, which are coherent to an all-trans conformation for the nonionic surfactants. Moreover, the integrated intensity of these bands is proportional to the density of surfactants.
Figure S5: temperature dependence of the Small Angle X-ray Scattering (SAXS) profiles of niobate nanosheets at a mass concentration of 2% and with C_{12}E_{5} nonionic surfactant at a mass concentration of w=0.15 for the temperature range 10-70°C.