Liquid Crystalline Property of Dimeric DEME Based Ionic Liquids Doped with Organic Solvents Containing Hydroxy Groups

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【Introduction】

Ionic liquids (ILs) are defined as "salts having a melting point below 100 °C" and consisting of organic ions as either or both anions and cations[1]. ILs have non-volatility, a wide potential window, high conductivity, and chemical stability, therefore it is expected to be applied as lubricants and electrolytes for electrical devices. Among them, ILs with *N*,*N*-diethyl-methyl-*N*-(2-methoxyethyl)ammonium (DEME) cations have been reported to exhibit relatively high electrochemical stability, because the cations have no π-conjugated system which shows relatively low stability to redox reactions [2]. In this study, we synthesized dimeric ILs (In-diDEME-X-14 (X = I, Br, Cl)) with two cationic moieties. In our previous study, it was revealed that the addition of water or organic solvents such as ethylene glycol to In-diDEME-I-14 induced the development of liquid crystalline phases. It has been considered that a hydrogen bonding between the nonionic moieties and the OH groups of the solvents affected the formation of liquid crystalline structures. However, the details have not been clarified. Therefore, we investigate the mechanism of the development of liquid crystalline phases when various solvents with OH groups are added.

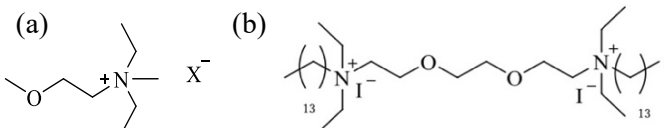

Fig.1 Structural formulas of (a) [DEME][X] and (b) In-diDEME-I-14

【Experiments】

In-diDEME-X-14 was synthesized. The samples were prepared by adding Ethylene Glycol, 1,2-Propanediol, 1,2-Butanediol, and 1,3-Butanediol to In-diDEME-I-14, respectively. The samples of In-diDEME-Br-14 and In-diDEME-Cl-14 with Ethylene Glycol were also prepared. The phase transition behavior of these samples was measured by using a polarized optical microscope (POM) and a differential scanning calorimeter (DSC). In addition, the liquid crystal structures of these samples were identified by X-ray diffraction (XRD) measurements. Moreover, the moisture contents in these samples were measured using a Karl Fischer moisture meter.

【Results】

According to the results of the POM observations and the DSC measurements, a liquid crystalline phase appeared in In-diDEME-X-14 with the addition of the solvent. The XRD results suggest that the different liquid crystalline phases are observed depending on the anion species.

【References】

1) K. Nishikawa, Y, Ouchi, T. Ito, H. Ohno, M. Watanabe, *Science of Ionic Liquids*, Maruzen Publishing, 2012, 7.
2) T. Sato and H. Yoshida, *Journal of the Society of Fiber Science and Technology*,2005, **61**, 75-79.