Faraday effect of imidazole derivatives and imidazolium halide ionic liquids

Małgorzata Paprzycka,[1] Marceli Koralewski,[1] and Mikołaj Baranowski[1]

[1] *Faculty of Physics Adam Mickiewicz University in Poznań, Uniwersytetu Poznańskiego 2 61-614 Poznań, Poland;*

Ionic liquids (ILs) are of great interest to researchers due to their spectacular physicochemical properties and applications [1]. A new subclass of ILs, which shows strong response to a magnetic field, was discovered in 2006. The magnetooptical (MO) properties of ILs are very rarely discussed in the literature, although our recent research has paved the way for the possible application of magnetic ILs (MILs) in photonics [2]. These facts motivated us to start with further studies on the basic compounds of most known ILs based on imidazole. In the paper, we present results of the magnetooptical rotatory dispersion (MORD), so called Faraday effect dispersion, of imidazole derivatives and commonly known imidazolium halides ILs with different alkyl chain length. We have shown that the MORD spectrum can be explained by using the model based on the Faraday B-terms according to Serber theory [2]. Additionally, using Pascal's and Lorentz-Lorenz relations, the magnetic susceptibility and the optical polarizability of the compounds were evaluated, respectively. The results obtained allow to establish the empirical relation between the Verdet constant and the alkyl chain length, as well as the optical polarizability and magnetic susceptibility. These relations will be very useful for designing new ILs/MILs and tuning their MO properties.

References:

[1] R. Hayes, G.G. Warr, R. Atkin, Structure and nanostructure in ionic liquids, Chem. Rev. 115 (2015) 6357–6426, https://doi.org/10.1021/cr50041q.

[2] M. Koralewski, M. Paprzycka, Faraday effect and refractive index of some imidazolium-based room-temperature ionic liquids and magnetic ionic liquids, Journal of Molecular Liquids, 375 (2023) 121375, https://doi.org/10.1016/j.molliq.2023.121375.