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Ionic liquid bmimCl/formamide mixture as the polar phase of nonaqueous microemulsions

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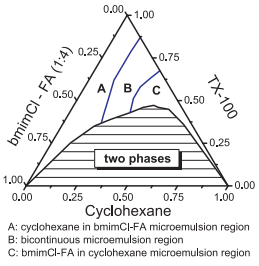
HIGHLIGHTS

- Microemulsions with ionic liquid and a nonaqueous polar solvent as the polar phase.
- Characterization by means of conductivity, DLS and UV–vis spectroscopy.
- Linear increase of the microemulsions droplet size by adding the polar phase.
- These nonaqueous microemulsions can dissolve metal salt.

GRAPHICAL ABSTRACT



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ABSTRACT

The solution of ionic liquid (IL) bmimCl and polar organic solvent formamide (FA) were used to form nonaqueous microemulsions in cyclohexane by the aid of surfactant Triton X-100 (TX-100). The phase behavior of the bmimCl–FA/TX-100/cyclohexane system at 25 ± 0.1 °C was studied. Electrical conductivity measurement was used to identify the microstructures of the nonaqueous microemulsions. Based on the phase diagram, the reverse microemulsions containing bmimCl–FA as the internal phase were investigated by the dynamic light scattering (DLS) and UV–vis spectroscopy. The result of DLS experiments confirmed the formation of reverse microemulsions of bmimCl–FA in cyclohexane. The UV–vis studies with methyl orange (MO) and methylene blue (MB) as absorption probes further confirmed the existence of reverse microemulsions. UV–vis studies using $CoCl_2$ as probe also indicated that the reverse microemulsions could dissolve metal salt.

1. Introduction

Microemulsions are transparent, isotropic and thermodynamically stable mixtures of two immiscible liquids (nonpolar and polar) stabilized by surfactants. The traditional reverse microemulsions use water as the polar component. The surfactant-covered water pools provide a unique microenvironment for reactions and nanoparticle preparation [1,2]. Reverse microemulsions can also be made using some polar organic solvents instead of water. These polar solvents have high dielectric constants and very low solubility in hydrocarbon solvents [3]. The most common polar solvents used for these nonaqueous microemulsions include formamide (FA), dimethylforamide (DMF), and ethylene glycol (EG) [4,5]. These waterless microemulsions have attracted much interest and have been widely applied in many fields.

Ionic liquids (ILs), which are typically composed of organic cations and organic/inorganic anions, are receiving much attention as neoteric solvents. They have many attractive properties, such as negligible vapor pressure, a wide electrochemical window, and high thermal stability. Particularly, the properties of ILs

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