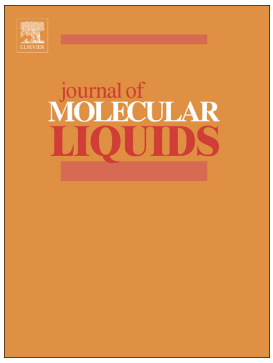

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Pressure-induced amorphization and crystallization of Choline chloride/Ethylene glycol deep eutectic solvent

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Abstract: The pressure-induced phase transitions of Choline chloride/Ethylene glycol (ChCl/EG) deep eutectic solvent have been studied at different rates of 0.2 and 1.0 GPa/s up to about 5.0 GPa. Two crystalline phases formed at 2.6 and 3.9 GPa with increasing pressure at lower compression rate, however, the amorphous phase solidified with superpressurized glass above 2.8 GPa at higher compression rate. The unusual results may be explained by the unique and characteristic structure of deep eutectic solvent and the supercooling induced by compression. The *P* versus *T* phase diagram of ChCl/EG deep eutectic solvent was constructed, and the solidification mechanism of ChCl-based deep eutectic solvent was discussed through the molecules packing of ChCl.

Keywords: deep eutectic solvent; ChCl/EG; high pressure; Raman

1. Introduction

Recently, Abbott and co-workers investigated a class of green media called deep eutectic solvents (DESs), which are formed by the complexation of a substituted quaternary ammonium salt with hydrogen-bond-forming compounds [1,2]. From both environmental and technological perspectives, DESs are superior to conventional solvents with the following advantages: (1) lower price, (2) easier preparation with higher purity, (3) higher biodegradability and lower toxicity and (4) greater designability with a broad selection of cations, anions, hydrogen-bond donors (HBDs), and salt/HBD molar ratios [3]. Therefore, DESs have currently attracted widespread academic and industrial interests with a broad range of applications due to these appealing properties [4-6]. Similar to conventional solvents, they are also being considered as a potential gas such as CO_2 or SO_2 absorption media [7,8]. Certain types of DESs have been found useful in a variety of electrochemical process such as electro deposition of metals, electro polishing of stainless steel and even the electro deposition of metal films [9-11], nanotube composites preparation, biocatalytic applications, and nanostructured Ni [6,11-13]. Although DESs have attracted much attention of chemists, there are still