

# Phase Behaviour and FTIR Spectra of Ionic Liquids: The Mixtures of 1-Butyl-1-methylpyrrolidinium Chloride and $\text{TaCl}_5$

Olga B. Babushkina

ECHEM Centre of Competence in Applied Electrochemistry, Viktor-Kaplan Straße 2,  
A-2700 Wiener Neustadt, Austria

Reprint requests to Dr. O. B. B.; Fax: ++43 (0) 2622 222 66 50; E-mail: olga.babushkina@echem.at

Z. Naturforsch. **63a**, 66–72 (2008); received July 19, 2007

*Presented at the EUCHEM Conference on Molten Salts and Ionic Liquids, Hammamet, Tunisia, September 16–22, 2006.*

A series of ionic liquids consisting of 1-butyl-1-methylpyrrolidinium chloride ( $\text{Pyr}_{14}\text{Cl}$ ) and  $\text{TaCl}_5$  at molar ratios of  $\text{Pyr}_{14}\text{Cl}$  in the range of 0.85–0.20 was synthesized. They exhibit potential application as electrolytes for the electrochemical deposition of tantalum. The thermal behaviour of the  $\text{Pyr}_{14}\text{Cl}$ - $\text{TaCl}_5$  mixtures was investigated, using differential scanning calorimetry (DSC) to estimate the range of thermal stability and to determine the optimal compositions for electrochemical trials. The  $\text{Pyr}_{14}\text{Cl}$ - $\text{TaCl}_5$  mixtures formed stoichiometric 3:2 and 2:3 crystalline phases with melting points of 70 °C and 130 °C, respectively, characterized by entropies of fusion of  $13.6 \text{ J K}^{-1} \text{ mol}^{-1}$  and  $10.1 \text{ J K}^{-1} \text{ mol}^{-1}$ . The mixtures with molar fractions of  $\text{Pyr}_{14}\text{Cl}$  equal to 0.60 and 0.40 were clear and transparent liquids and had the lowest viscosity; they were the most suitable for electrochemical applications.

FTIR spectra of the  $\text{Pyr}_{14}\text{Cl}$ - $\text{TaCl}_5$  mixtures allowed to get insight into inter-ionic interactions and the nature of formation of these ionic liquids as a function of the molar ratio of the components.

*Key words:* Ionic Liquids; Pyrrolidinium; Tantalum; Thermal Behaviour; FTIR Spectroscopy.