IONIC LIQUIDS:

AN EFFICIENT TOOL FOR TUNING ANALYTICAL CHARACTERISTICS OF ION-SELECTIVE SENSORS

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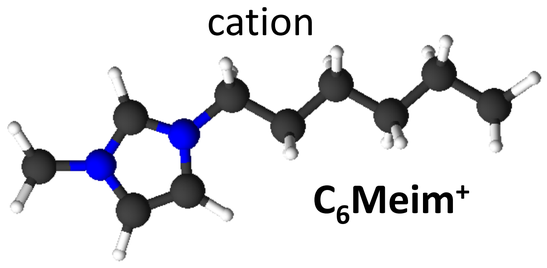
INTRODUCTION

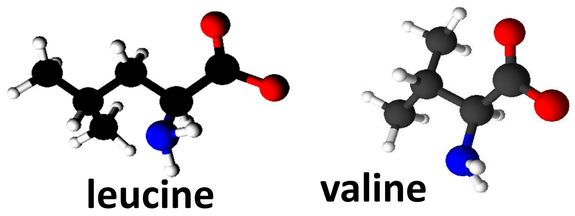
Interest in reducing industrial impact on environment led to resurgence of ionic liquids, mainly due to their non-volatility and tunability of their properties. In this contribution, we explore use of ILs in polymeric ion-selective sensors (ISSs). ILs are used in membranes of ion-selective electrodes to improve their sensitivity and selectivity; as a plasticizer; as a stabilizer for the interfacial potential, which is a requirement for reference electrodes without a liquid junction (LJF-REs). However, the available data on the behavior of such membranes are fragmentary and inconsistent. We studied the effect of 1-hexyl-3-methyl-1*H*-imidazol-3-ium bis[(trifluoromethyl)sulfonyl]azanide ($C_6MeimNTf_2$) in the plasticizing mixture on properties of polyvinylchloride (PVC) membranes as well as ILs with amino acid anions for use in PVC sensing membranes.

APPROACHES

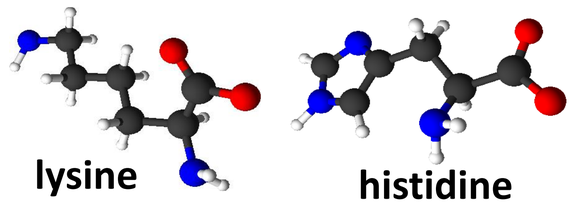
cation



amino acid anions



anion NTf_2^-

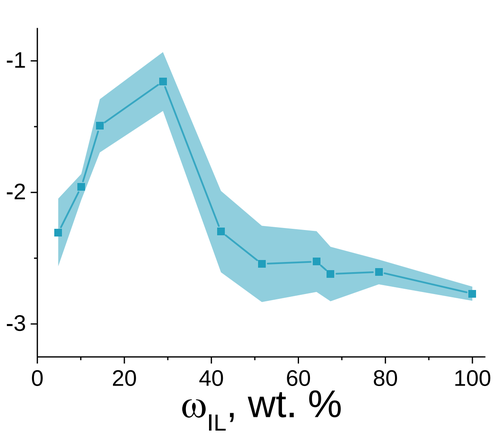


- stabilization of interfacial potential[1]
- tunable properties of the sensing phase: polarity, viscosity, electrolytic behavior
- adjustable analytical characteristics, e.g. dynamic range

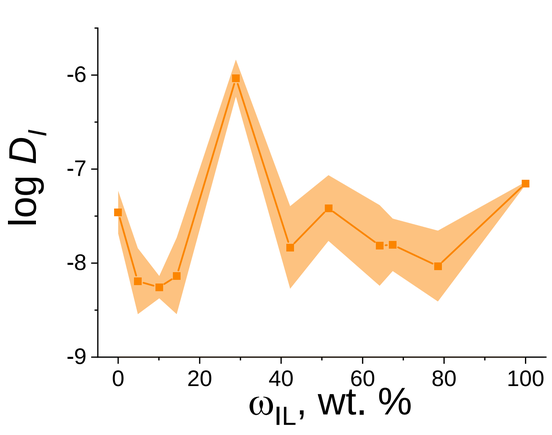
RESULTS

electrolytic properties

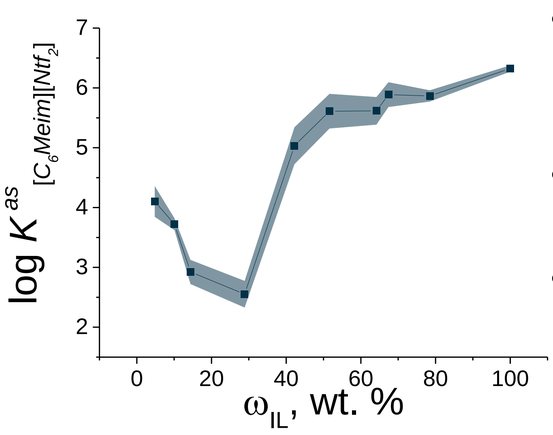
charge carriers concentration



diffusion coefficients



association constant

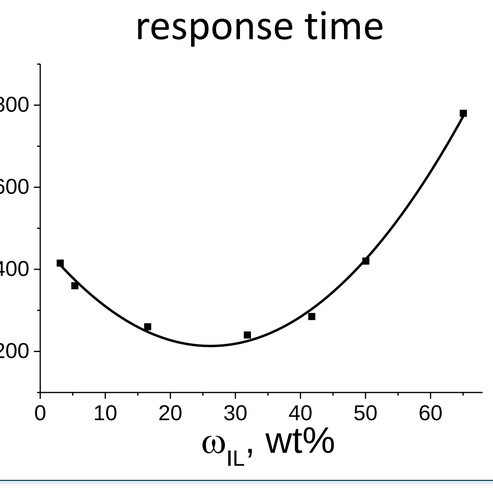


$C_6MeimNTf_2$ in ISSs

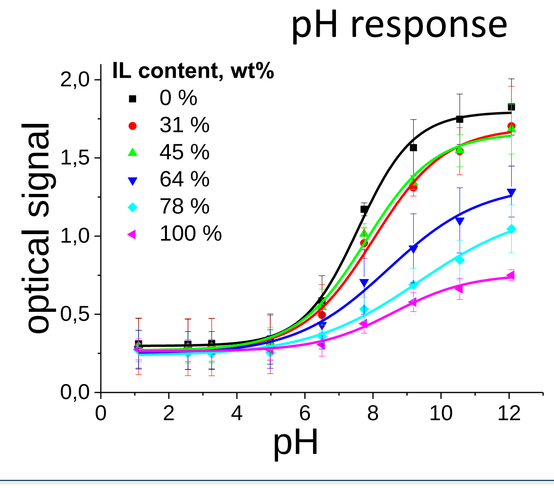
- non-monotonic change of electrolytic properties with IL content in PVC phase
- extremum at 25-30 wt% of IL in the plasticizing mixture
- resistance, viscosity, and polarity of the sensor can be controlled by varying the amount of IL
- response range can be tuned: pH response shifts to the more basic range; Na^+ response shifts to the more concentrated domain
- Na^+ response can be suppressed while pH response is still significant: can be used for single-ion sensing[2]

IL in optical sensors

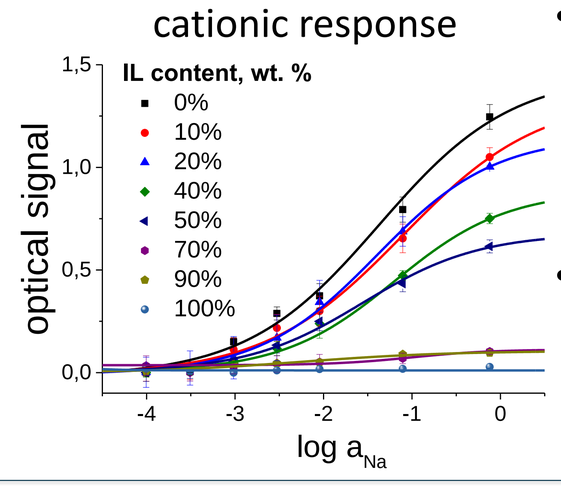
response time



pH response

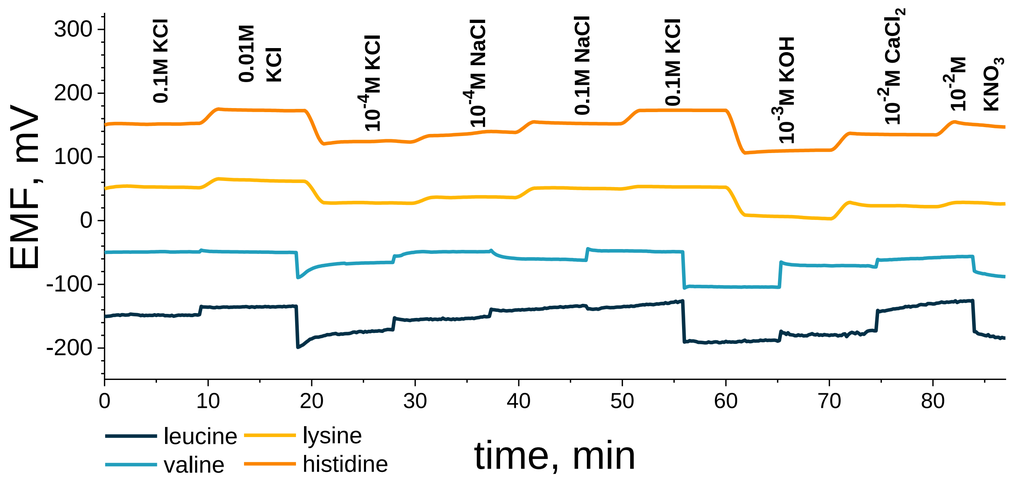


cationic response

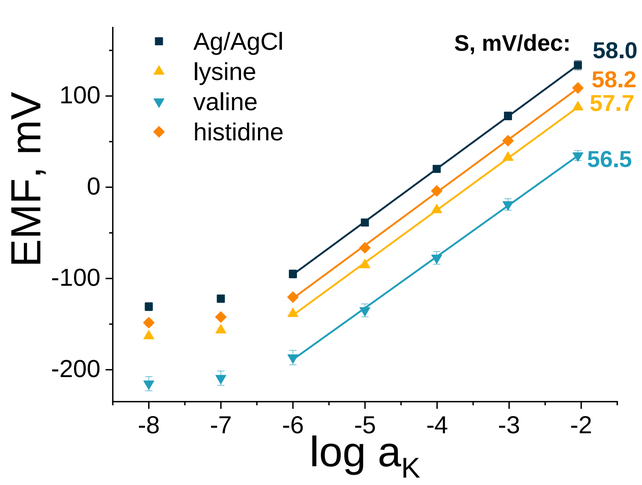


IL-based reference electrodes

EMF stability in different background electrolytes



K^+-selective electrodes vs. novel REs



amino acid-based ILs in reference electrodes

- stable work as LJF-REs due to the stability of interfacial potential[1]
- less environmental impact from amino acids-based ILs[3]
- valine-based IL demonstrated the most promising potentiometric performance

ACKNOLEDGMENTS AND REFERENCES

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[1] Vincze, A. *et al. Electrochem. Soc. Proc.* **1997**, *97–19*, 550–555.
[2] Stashkova, A. E. *et al. Sensors Actuators, B Chem.* **2015**, *207* (Part A), 346–350.
[2] Egorova, K. S. *et al.*. *Toxicol. Res. (Camb).* **2015**, *4* (1), 152–159.