

## Accepted Manuscript

Kinetics and mechanism of corrosion of mild steel in new types of ionic liquids

A.A. Kityk, Y.D. Rublova, A. Kelm, V.V. Malyshev, N.G. Bannyk, I. Flis-Kabulska



PII: S1572-6657(18)30432-6  
DOI: doi:[10.1016/j.jelechem.2018.06.018](https://doi.org/10.1016/j.jelechem.2018.06.018)  
Reference: JEAC 4116

To appear in: *Journal of Electroanalytical Chemistry*

Received date: 23 February 2018  
Revised date: 4 June 2018  
Accepted date: 11 June 2018

Please cite this article as: A.A. Kityk, Y.D. Rublova, A. Kelm, V.V. Malyshev, N.G. Bannyk, I. Flis-Kabulska, Kinetics and mechanism of corrosion of mild steel in new types of ionic liquids. *Jeac* (2017), doi:[10.1016/j.jelechem.2018.06.018](https://doi.org/10.1016/j.jelechem.2018.06.018)

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

**Kinetics and mechanism of corrosion of mild steel in new types of ionic liquids**Kityk A.A.<sup>1,2</sup>, Rublova Y.D.<sup>1</sup>, Kelm A.<sup>3</sup>, Malyshev V.V.<sup>3</sup>, Bannyk N.G.<sup>1</sup>,Flis-Kabulska I.<sup>4</sup><sup>1</sup>*Ukrainian State University of Chemical Technology, Gagarin Ave., 8, Dnipro, Ukraine,*<sup>2</sup>*e-mail kitykanna7@gmail.com*<sup>3</sup>*Institute of Physical Chemistry, Polish Academy of Science, Kasprzaka 44/52, Warsaw, Poland*<sup>4</sup>*University of Cardinal Stefan Wyszyński, Wóycickiego 1/3, Warsaw, Poland***Abstract**

It has been established that the corrosion of mild steel in *Ethaline* and *Reline* (choline chloride based deep eutectic solvents with the ethylene glycol and urea respectively) occurs with oxygen depolarization. The rate of corrosion is significantly affected by the contact time of solvents with air and temperature. These two factors determine the physicochemical properties and play a decisive role in the rate of diffusion of the depolarizer, and hence the corrosion rate. It is shown that both solvents are hygroscopic (for 160 hours of contact with air in *Ethaline* 15 vol.% of water is detected, in *Reline* about 7 vol.%). It is noted that the rate of corrosion of mild steel in *Ethaline* is noticeably higher than in *Reline*. However, when operating temperatures of solvents becomes to  $\approx 70\div 80$  °C the corrosion rates in *Ethaline* and *Reline* is very close to each other, which is primarily due to the convergence of the viscosity parameters. SEM studies of the surface of the steel samples showed that in *Ethaline* and *Reline* solvents corrosion occurs with the formation of pitting and elements of subsurface corrosion. The mechanism of corrosion is established and the essential role of chloride anions in the formation of intermediate corrosion products is shown.

**Key words:** choline chloride; deep eutectic solvents; impedance; voltammetry; Raman spectroscopy; SEM

**Introduction**

The new class of ionic liquids called deep eutectic solvents (DESs) has become widespread in recent decades [1-3]. DESs can be an alternative to traditional toxic solvents currently used in different fields of science and technology. DESs have a lot of advantages such as a lack of toxicity, low volatility, incombustibility, thermal and chemical stability, the wide range of electrochemical stability. DESs are safe for humans and environment and fulfil all requirements of “green chemistry” [1-6].

Choline chloride is one of the most popular components of DESs. It is a quaternary ammonium salt which can form eutectic mixtures with very low crystallization temperature with

Download English Version:

<https://daneshyari.com/en/article/6661573>

Download Persian Version:

<https://daneshyari.com/article/6661573>

[Daneshyari.com](https://daneshyari.com)