

## Accepted Manuscript

Kinetic study of the hydrogen evolution reaction in slightly alkaline electrolyte on mild steel, goethite and lepidocrocite

Kristoffer Hedenstedt, Nina Simic, Mats Wildlock, Elisabet Ahlberg

PII: S1572-6657(16)30613-0  
DOI: doi: [10.1016/j.jelechem.2016.11.011](https://doi.org/10.1016/j.jelechem.2016.11.011)  
Reference: JEAC 2941

To appear in: *Journal of Electroanalytical Chemistry*

Received date: 30 December 2015  
Revised date: 15 October 2016  
Accepted date: 7 November 2016



Please cite this article as: Kristoffer Hedenstedt, Nina Simic, Mats Wildlock, Elisabet Ahlberg, Kinetic study of the hydrogen evolution reaction in slightly alkaline electrolyte on mild steel, goethite and lepidocrocite, *Journal of Electroanalytical Chemistry* (2016), doi: [10.1016/j.jelechem.2016.11.011](https://doi.org/10.1016/j.jelechem.2016.11.011)

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.

## Kinetic study of the hydrogen evolution reaction in slightly alkaline electrolyte on mild steel, goethite and lepidocrocite

Kristoffer Hedenstedt<sup>1,2</sup>, Nina Simic<sup>1</sup>, Mats Wildlock<sup>1</sup> and Elisabet Ahlberg<sup>2,\*</sup>

<sup>1</sup>AkzoNobel Pulp and Performance Chemicals, SE-445 80 Bohus, Sweden

<sup>2</sup>Department of Chemistry and Molecular Biology, University of Gothenburg, Kemigården 4, SE-412 96 Gothenburg, Sweden

\*Corresponding author. ela@chem.gu.se, +46 317869002

Keywords: Chlorate process, electrocatalysis, Fe(II) surface species, surface complexation

### Abstract

Hydrogen evolution is the main cathodic reaction in the sodium chlorate process. Two types of corrosion products,  $\alpha$ -FeOOH (goethite) and  $\gamma$ -FeOOH (lepidocrocite), commonly found on cathodes in the industrial process, and mild steel have been investigated by electrochemical methods to determine the rate constants and transfer coefficients for the hydrogen evolution reaction. The results show that after an initial reduction of the iron oxyhydroxides the activity for hydrogen evolution from water is similar for all three surfaces. *Ex situ* x-ray diffractions studies were made to reveal structural changes after polarisation in the hydrogen evolution region but only the bulk materials were detected. This indicates that the reduction process is limited to the surface layer. The experimental results clearly show that the first electron transfer is rate limiting and the low transfer coefficients indicate that the transition state is closer to adsorbed hydrogen than to water in solution. It is therefore suggested that the active site for water reduction is the protonated surface group  $\equiv Fe(II) - OH_2^+$  and the mechanism for hydrogen evolution is discussed in the context of the general Volmer-Tafel-Heyrovsky scheme valid for metal surfaces.

Download English Version:

<https://daneshyari.com/en/article/6477049>

Download Persian Version:

<https://daneshyari.com/article/6477049>

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