Accepted Manuscript

Modelling of hydrogen permeation experiments in iron alloys: Characterization of the accessible parameters – Part II – The exit side

Lorenzo Vecchi, Hans Simillion, Rodrigo Montoya, Dries Van Laethem, Emilie Van den Eeckhout, Kim Verbeken, Herman Terryn, Johan Deconinck, Yves Van Ingelgem

PII: S0013-4686(17)32747-0

DOI: 10.1016/j.electacta.2017.12.173

Reference: EA 30961

To appear in: *Electrochimica Acta*

Received Date: 20 July 2017

Revised Date: 21 December 2017

Accepted Date: 27 December 2017

Please cite this article as: L. Vecchi, H. Simillion, R. Montoya, D. Van Laethem, E. Van den Eeckhout, K. Verbeken, H. Terryn, J. Deconinck, Y. Van Ingelgem, Modelling of hydrogen permeation experiments in iron alloys: Characterization of the accessible parameters – Part II – The exit side, *Electrochimica Acta* (2018), doi: 10.1016/j.electacta.2017.12.173.

Modelling of Hydrogen Permeation Experiments in Iron Alloys: Characterization of the Accessible Parameters – Part II – The Exit Side

Lorenzo Vecchi[1], Hans Simillion[1], Rodrigo Montoya[1], Dries Van Laethem[1], Emilie Van den Eeckhout[2], Kim Verbeken[2], Herman Terryn[1], Johan Deconinck[1], Yves Van Ingelgem[1]

[1]Research Group Electrochemical and Surface Engineering (SURF), Dept. of Materials & Chemistry (MACH), Vrije Universiteit Brussel (VUB), Pleinlaan 2, B-1050 Brussels, Belgium

[2]Department of Materials, Textiles and Chemical Engineering, Ghent University (UGent), Technologiepark Zwijnaarde 903, 9052 Ghent, Belgium

Keywords: Hydrogen Permeation, Corrosion, Modelling, Devanathan-Stachurski cell, Iron alloys

Abstract

Electrochemical permeation tests are used to investigate the diffusion and trapping effects of hydrogen in a metal. For a quantitative and reliable evaluation of these features, the development of a numerical model is required. In the first paper of this series, we developed a model describing the hydrogen transport process in the Devanathan-Stachurski cell and evaluated the influence of the entry interface on the experimental results. Although many models have already been proposed for the description of the hydrogen diffusion in the Devanathan-Stachurski cell, none of them is including the simulations of the anodic side of the cell. In this paper, we present a new model representing the Devanathan-Stachurski cell. With this model, we are able to make a sensitivity analysis of all the parameters that play a role during the hydrogen diffusion process in iron alloys, comprising the adsorption, absorption, diffusion and desorption processes that the hydrogen undertakes in the sample mounted in the Devanathan-Stachurski cell. In particular, we found that the common assumption of constant zero concentration at exit side broadly accepted by researchers may not always reflect the real situation and the evaluation of the desorption