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

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Abstract

The Devanathan-Stachurski cell is an electrochemical technique used to investigate the hydrogen diffusion and trapping in the bulk of a metal. The process of absorption and diffusion of atomic hydrogen through a metal is not fully understood yet. To investigate this problem further, we investigate the effects of hydrogen adsorption, absorption and trapping in iron alloys through the development of a numerical model representing the Devanathan-Stachurski cell. In this paper, we review how each single input parameter can be evaluated and present an investigation of the accessible parameters reporting their influence on the experimental results. In particular, we highlight the impact of the hydrogen adsorption-absorption process on the hydrogen flux passing through the metal sample. Hence, the surface state and the electrolyte influence are proven to be significant parameters influencing the overall hydrogen transport process. This effect is often overlooked in the experimental result evaluation. To come to an even more complete understanding of the situation an evaluation of the influence of the anodic side of the cell will be proposed in our follow-up paper.