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# Effect of prestrain on hydrogen diffusion and trapping in structural steel

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## Abstract

Hydrogen permeation tests were electrochemically performed to measure hydrogen diffusion and trapping in EH 36 steel. Permeation transients were measured through charging and decaying cycles, for specimens prestrained to varying degrees (0-20%). With increasing prestrain, the effective hydrogen diffusivity ( $D_{eff}$ ) decreased, while the total/reversible hydrogen content ( $C_o$  and  $C_r$ , respectively) increased. The immobile dislocation of the 20%-prestrained specimens decreased  $D_{eff}$  by approximately ten times and increased  $C_o$  and  $C_r$  by approximately three times. The amount of irreversibly trapped hydrogen ( $C_{irr}$ ) remained approximately the same, regardless of the prestrain. The dislocations delay the motion of hydrogen and contain more reversible hydrogen.

**Keywords:** Steel, Electrochemical permeation, Prestrain, Hydrogen embrittlement, Hydrogen diffusion, Hydrogen trapping

## 1. Introduction

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