FACULTY OF ENGINEERING AND ARCHITECTURE

DEPARTMENT OF MATERIALS, TEXTILES AND CHEMICAL ENGINEERING

SUSTAINABLE MATERIALS SCIENCE

STRESS-CORROSION CRACKING IN ACIDIC AQUEOUS ENVIRONMENT

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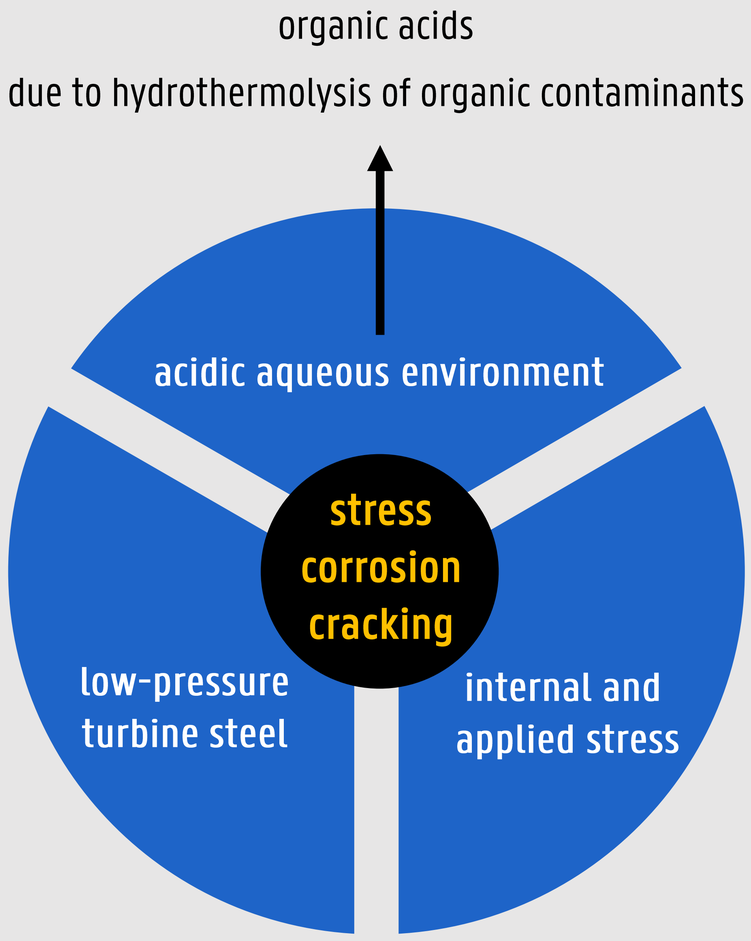
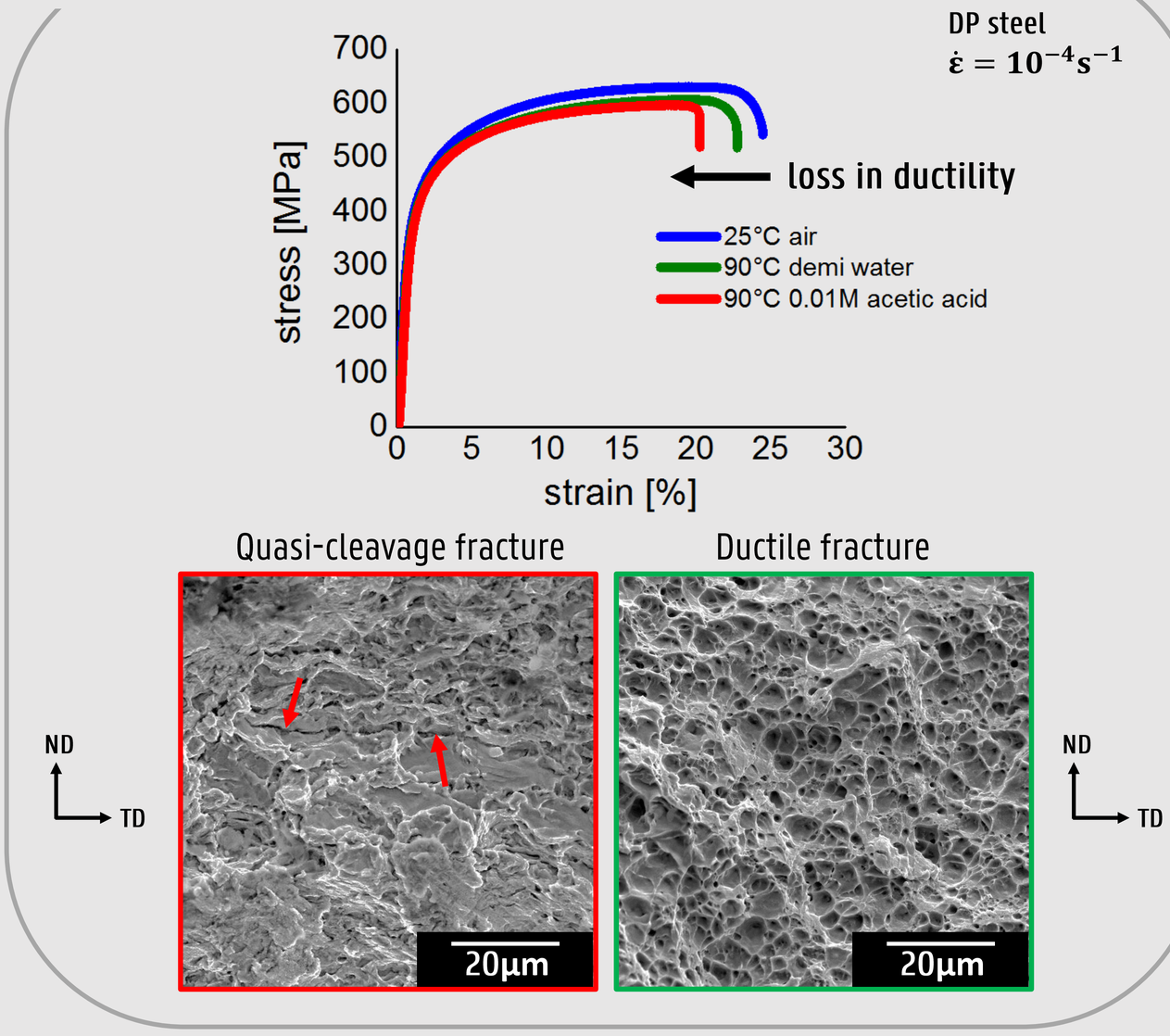
Introduction

Acidic stress-corrosion cracking of low-pressure steam turbine steels can be induced by the presence of organic acids in the first condensate of steam/water cycles. In this work, the mechanism behind the mechanical degradation caused by acidic stress-corrosion cracking was investigated.

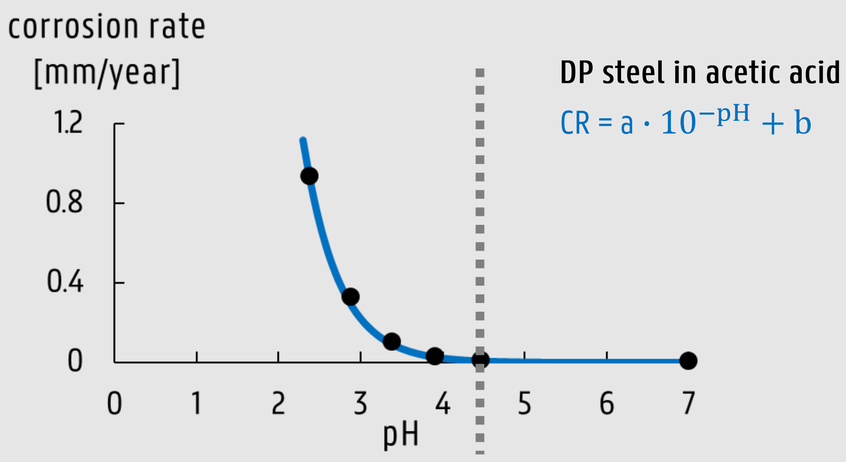
Corrosion phenomenon

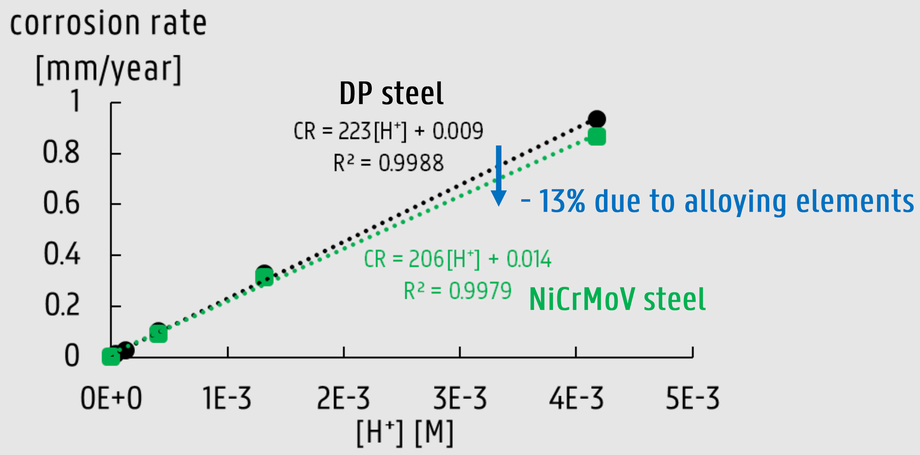


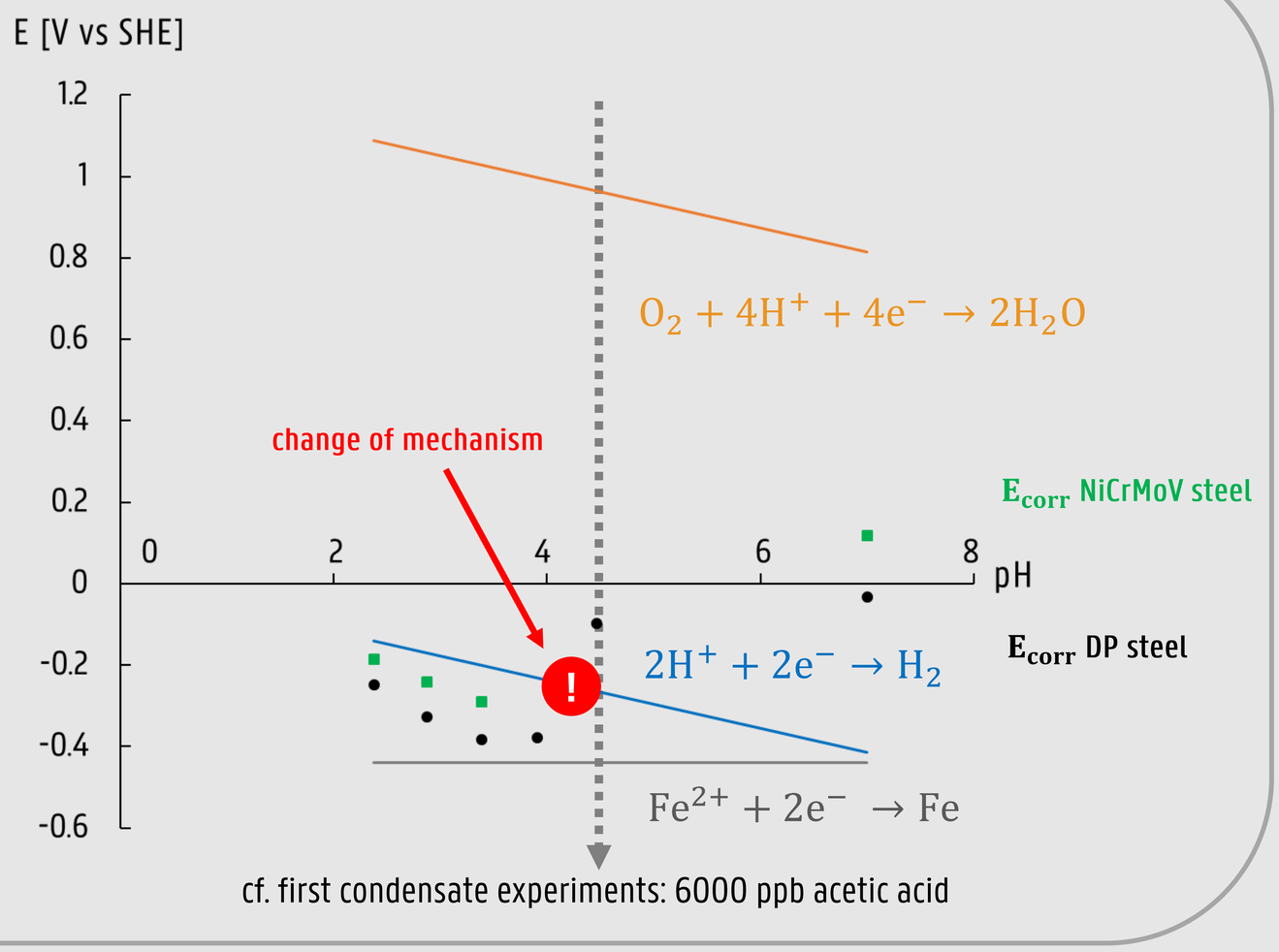
Mechanical degradation



Mechanism







cf. first condensate experiments: 6000 ppb acetic acid

Conclusions

- A loss in ductility was observed when acetic acid was added in the aqueous environment of the steel, causing (H-induced) quasi-cleavage fracture
- A linear relationship between the corrosion rate and the hydrogen proton concentration was determined, which was affected by the alloying content
- A change in corrosion mechanism was indicated by corrosion potential measurements, i.e. the activation of hydrogen reduction when lowering the pH
- Appropriate water purification regarding organic acids is needed to limit the corrosion rate, as well as to prevent H reactions, inducing H-damage

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