

M. Kimura LAB.

[Hydrogen Compatible Metal Strength]

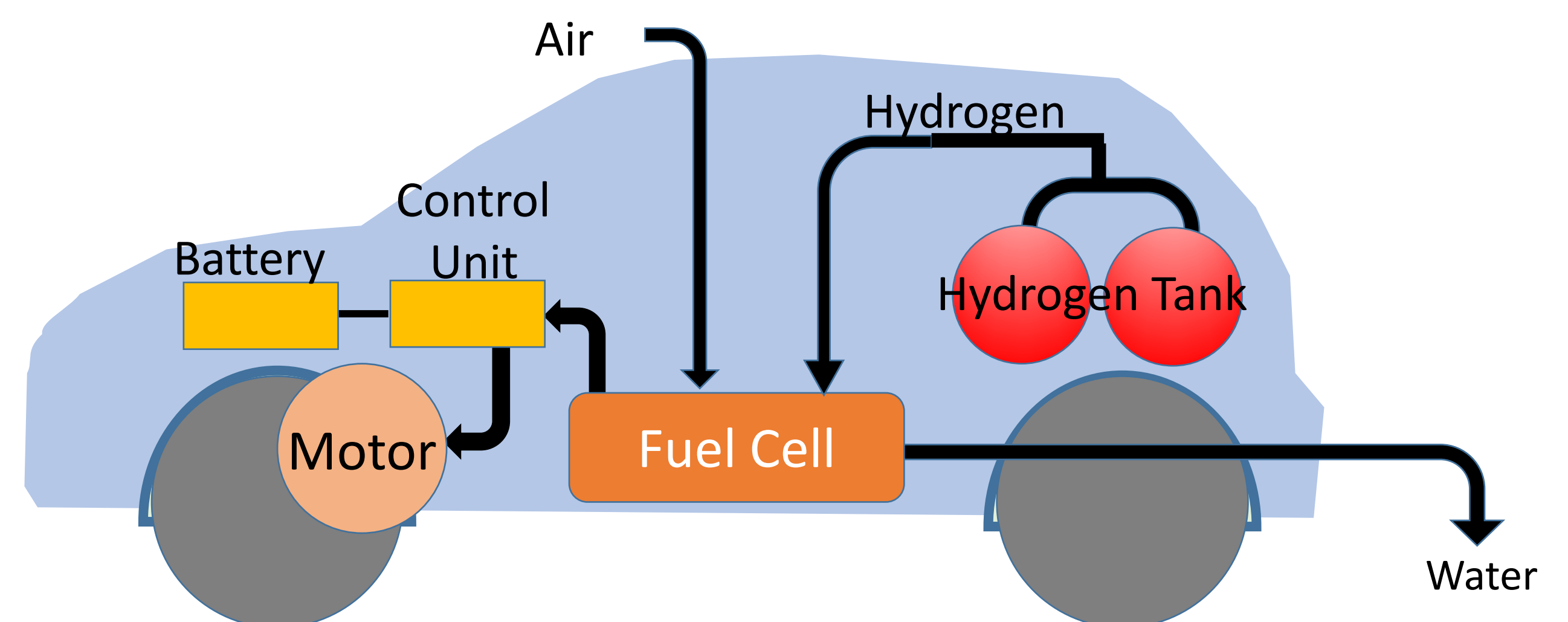


Department of Fundamental Engineering

Material for Hydrogen Embrittlement Resistance

Test Method to Establish Hydrogen Compatibility of Materials in High Pressure Hydrogen Gas Environment

Hydrogen energy is attracting attention for the realization of a low-carbon society. On the other hand, when metallic materials are exposed to high-pressure hydrogen environments, hydrogen atoms enter the material, and some kinds of materials show high susceptibility to hydrogen embrittlement. Therefore, it is necessary to clarify the suitable material used in the high pressure hydrogen environment and hydrogen compatible test method have been required in many fields, including hydrogen stations and fuel cell fields etc.. We have conducted to achieve global harmonization of hydrogen compatibility testing in the high pressure hydrogen environment.



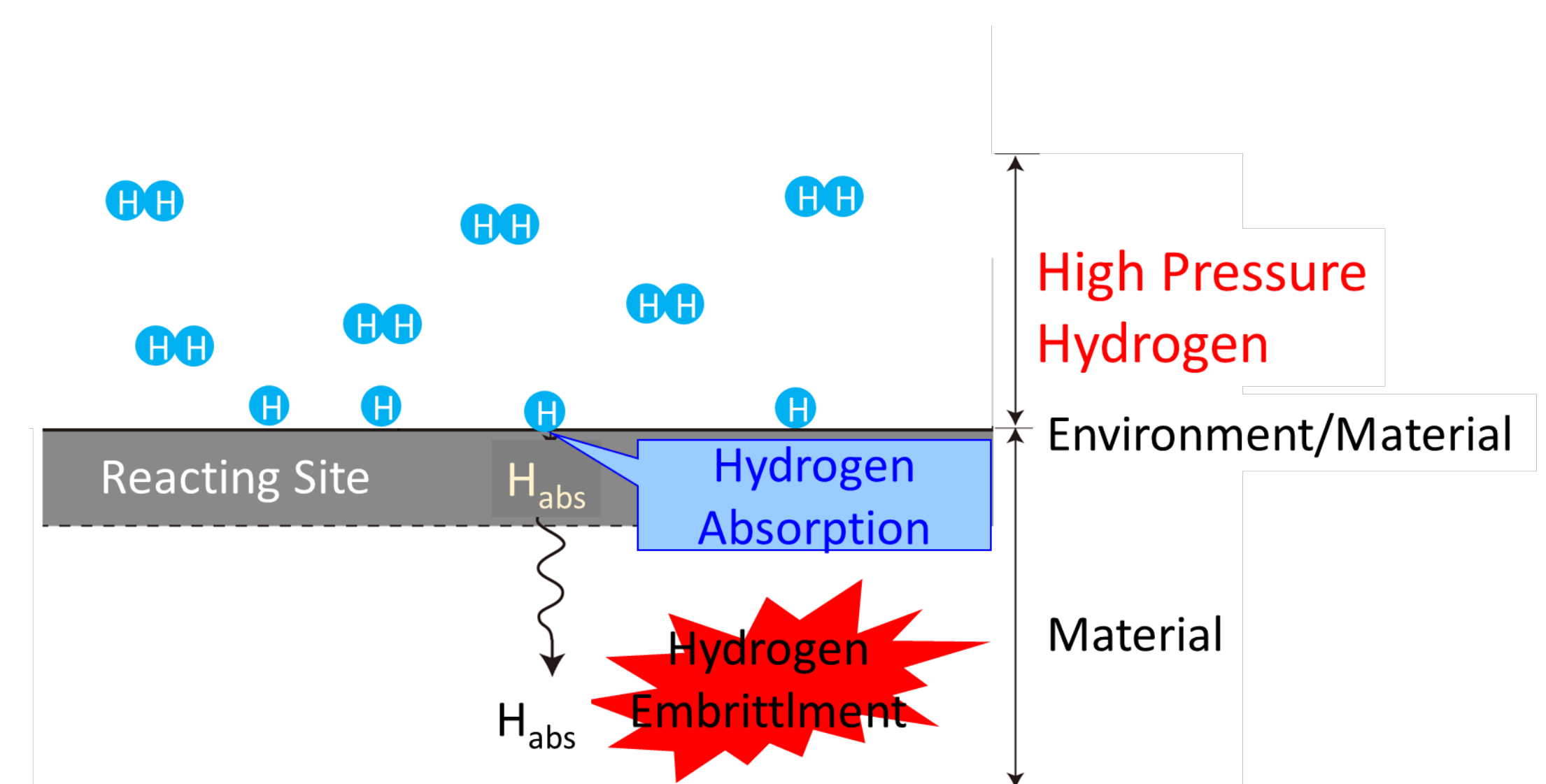
Mechanism of Hydrogen embrittlement

- ① Hydrogen atoms adsorb on the material surface
- ② Hydrogen atoms penetrate the interface of material
- ③ Hydrogen atoms diffuse in materials

Hydrogen Compatibility Testing

The hydrogen compatibility of metallic materials used for component of FCVs has been evaluated by following testing method.

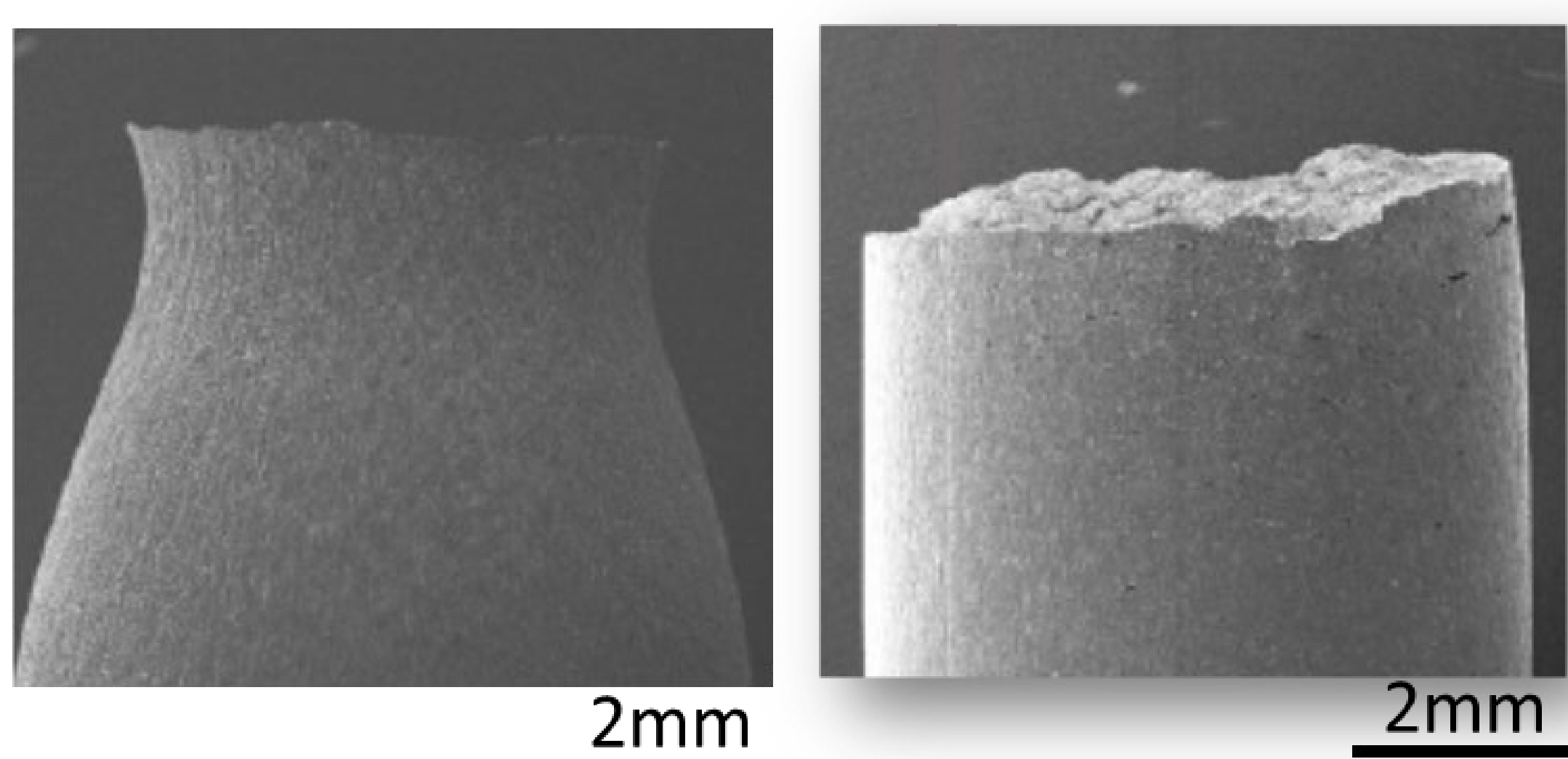
- ① Slow Strain Rate Technique (SSRT) Testing
- ② Fatigue Life Testing
- ③ Fatigue Crack Growth Rate Testing



Mechanism of hydrogen embrittlement in the high pressure hydrogen gaseous environment

Tensile properties of SUS304 in high pressure H₂

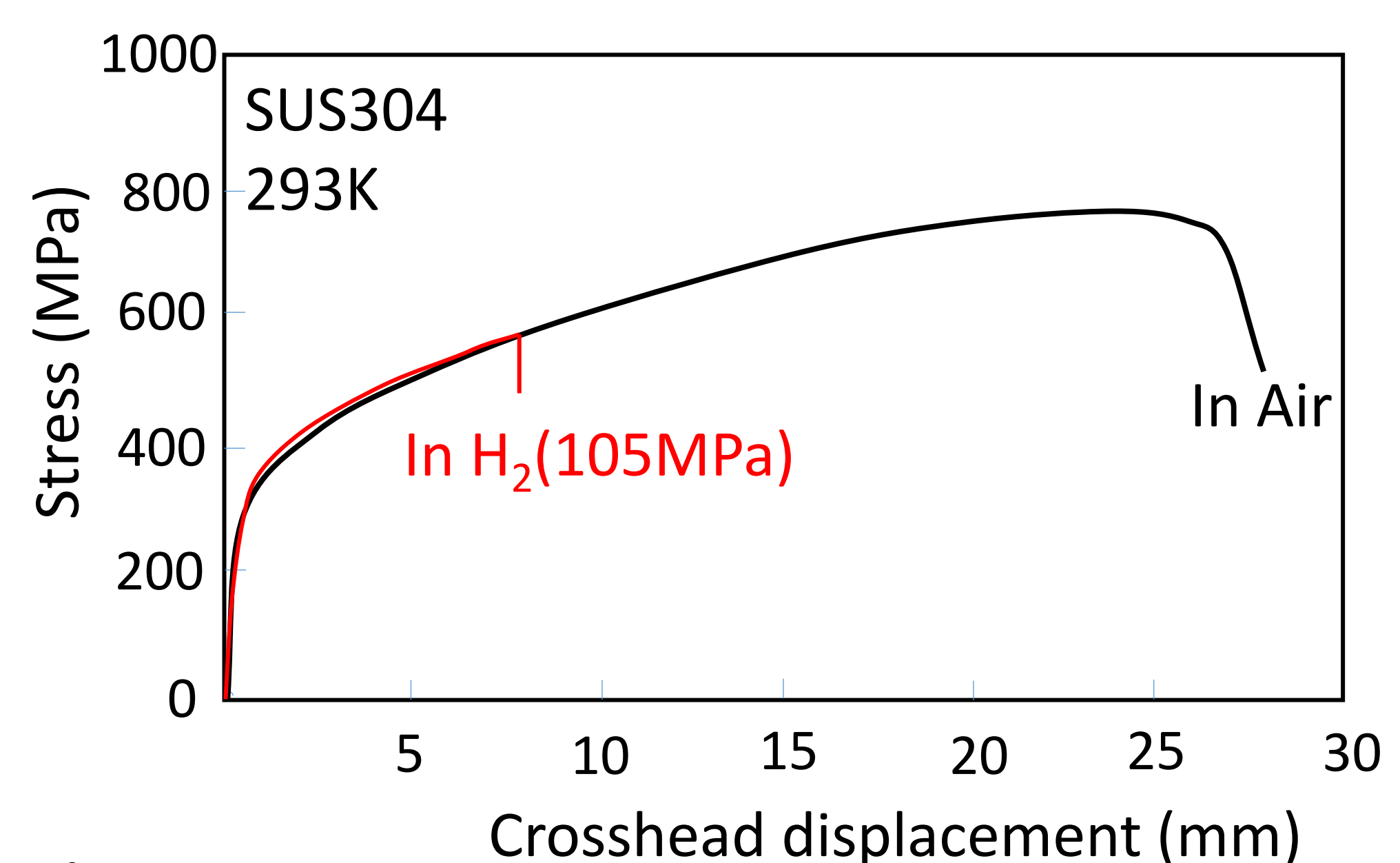
- Yield point did not change in hydrogen.
- Ductility deterioration was observed.



In Air

In H₂ Gas(105MPa)

Appearance of SSRT tested specimens in H₂ and air environment



Tensile properties of materials in H₂ and air environment