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

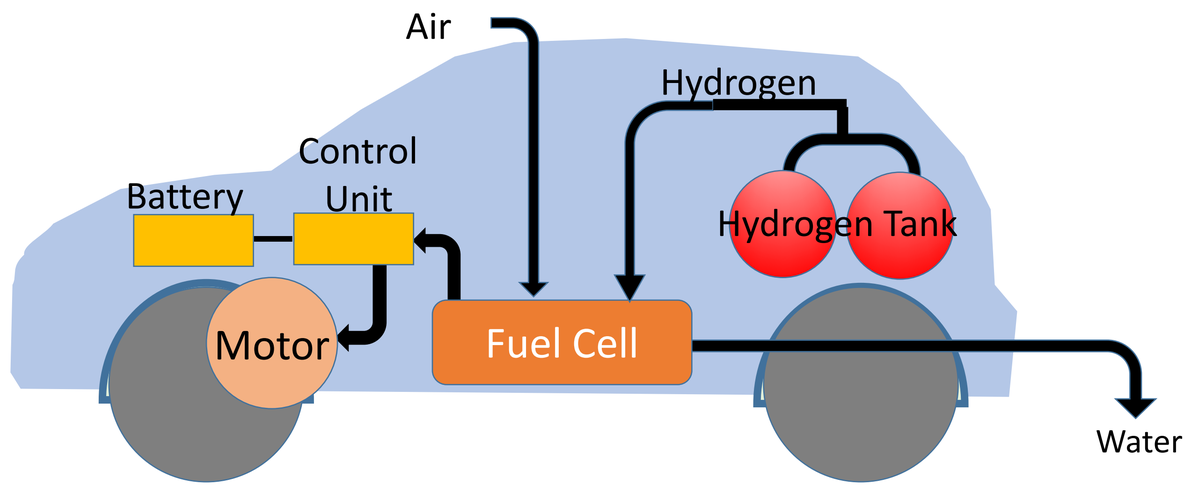
Hydrogen energy is attracting attention for the realization of a low-carbon society. On the other hand, when metallic materials are exposed to high-pressure hydrogen environments, hydrogen atoms enter the material, and some kinds of materials show high susceptibility to hydrogen embrittlement. Therefore, 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.

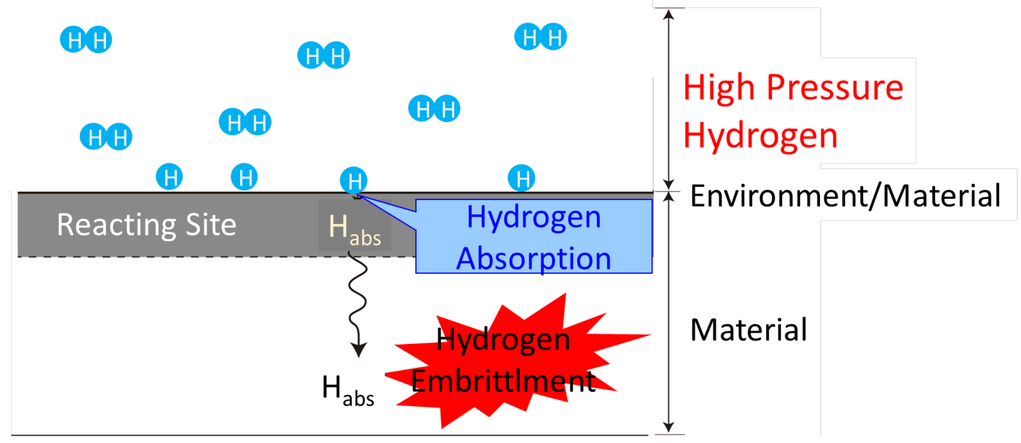
Mechanism of Hydrogen embrittlement

①Hydrogen atoms adsorb on the material surface
②Hydrogen atoms penetrate the interface of material
③Hydrogen 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.
①Slow Strain Rate Technique (SSRT) Testing
②Fatigue Life Testing
③Fatigue Crack Growth Rate Testing

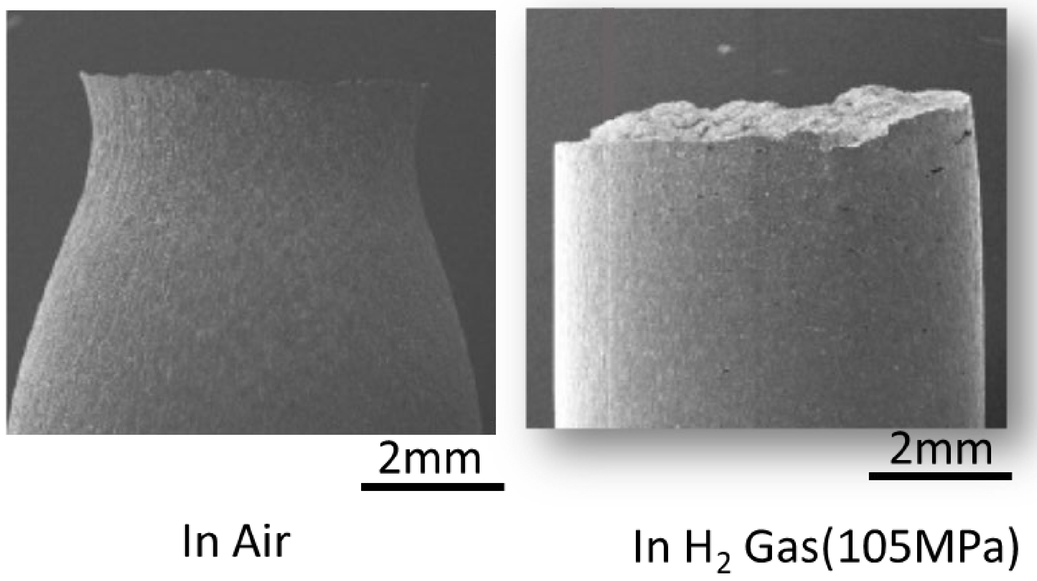




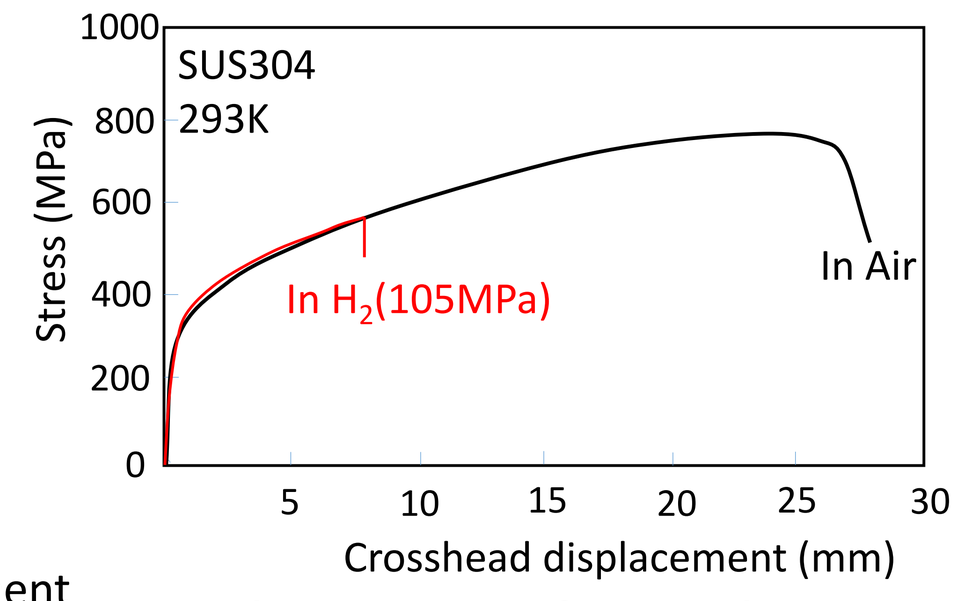
Mechanism of hydrogen embrittlement in the high pressure hydrogen gaseous environment

Tensile properties of SUS304 in high pressure H_2

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



Appearance of SSRT tested specimens in H_2 and air environment



Tensile properties of materials in H_2 and air environment