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[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

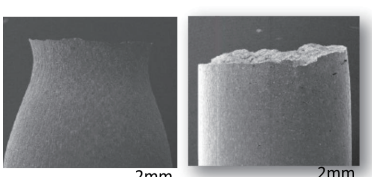
Hydrogen energy is attracting attention for the realization of a low-carbon society. 70 MPa-class fuel cell vehicles (FCVs) have already been commercialized in several countries. Some load-bearing components in such systems are exposed to high pressure hydrogen gas environments and some kinds of material show high susceptibility to hydrogen embrittlement in these environments. The hydrogen compatible test has been conducted in the discussion of the Global Technology Regulation No13 under collaboration with relevant countries. Therefore, we have conducted to achieve global harmonization of hydrogen compatibility testing in high pressure gaseous hydrogen .(*1)

Mechanism of Hydrogen embrittlement

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

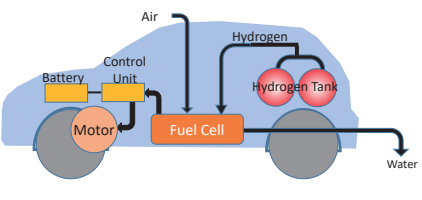
Hydrogen Compatibility Testing

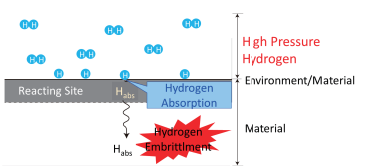
The hydrogen compatibility of metallic materials used for component of FCVs has been evaluated by following testing method.
①Slow Strain Rate Technique (SSRT) Testing
②Fatigue Life Testing
③Fatigue Crack Growth Rate Testing



In Air In H_2 Gas(105MPa)

Appearance of SSRT tested specimens in H_2 and air environment

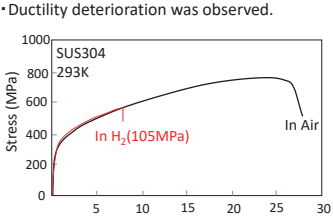




Mechanism of hydrogen embrittlement in the high pressure hydrogen gaseous environment

Tensile properties of SUS304 in high pressure H_2

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



Tensile properties of materials in H_2 and air environment

• 1This Work was commissioned by JARI supported from NEDO