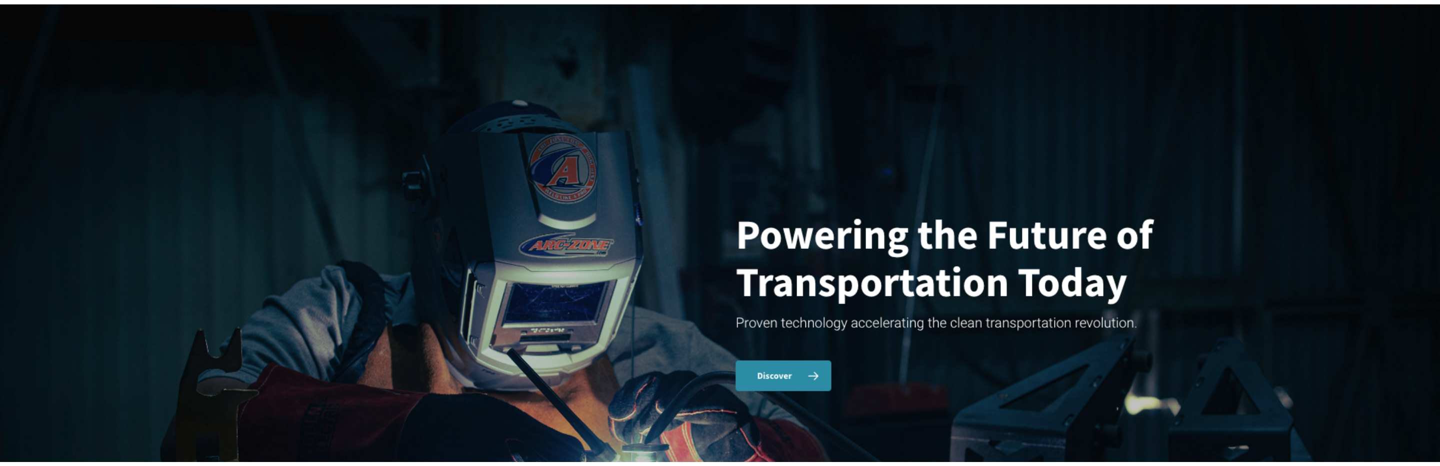

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US Hybrid specializes in designing and manufacturing power conversion systems for medium and heavy-duty electric, hybrid and fuel cell commercial buses and trucks.

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Clients

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The Science of Hydrogen

Hydrogen Fuel Cell Technology

Combining a mole of hydrogen gas and a half-mole of oxygen gas from their normal diatomic forms produces a mole of water. A detailed analysis of the process makes use of the thermodynamic potentials. This process is presumed to be at 298K and one-atmosphere pressure, and the relevant values are taken from a table of thermodynamic properties.

Energy is provided by the combining of the atoms and from the decrease of the volume of the gases. At temperature 298K and one-atmosphere pressure, the system work is

> W = PDV = (101.3 x 103 Pa)(1.5 moles)(-22.4 x 10-3 m3/mol)(298K/273K) = -3715 J

Since the enthalpy H= U+PV, the change in internal energy U is then

> DU = DH – PDV = -285.83 kJ + 3.72 kJ = -282.1 kJ

The entropy of the gases decreases by 48.7 kJ in the process of combination since the number of water molecules is less than the number of hydrogen and oxygen molecules combining. Since the total entropy will not decrease in the reaction, the excess entropy in the amount TDS must be expelled to the environment as heat at temperature T. The amount of energy per mole of hydrogen which can be provided as electrical energy is the change in the Gibbs free energy:

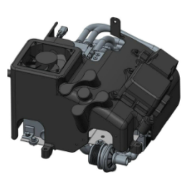
> DG = DH – TDS = -285.83 kJ + 48.7 kJ = -237.1 kJ

For this ideal case, the fuel energy is converted to electrical energy at an efficiency of 237.1/285.8 x100% = 83%

Comparison of Electrolysis and the Fuel Cell Process

In comparing the fuel cell process to its reverse reaction, electrolysis of water, it is useful to treat the enthalpy change as the overall energy change. The Gibbs free energy is that which you must supply if you want to drive a reaction, or the amount that you can achieve the reaction is working for you. In the electrolysis/fuel cell pair where the enthalpy change is 285.8 kJ, you must put in 237 kJ of energy to drive electrolysis and the heat from the environment will contribute TDS=48.7 kJ to help you. Going the other way in the fuel cell, you can get out the 237 kJ as electric energy, but must discard TDS = 48.7 kJ to the environment.

Fuel Cell Products



FCe™10 (10kW)

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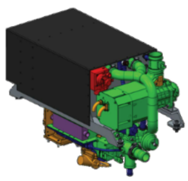

FCe™40 (40kW)

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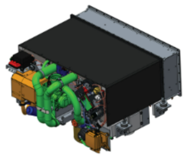

FCe™100 (100kW)

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