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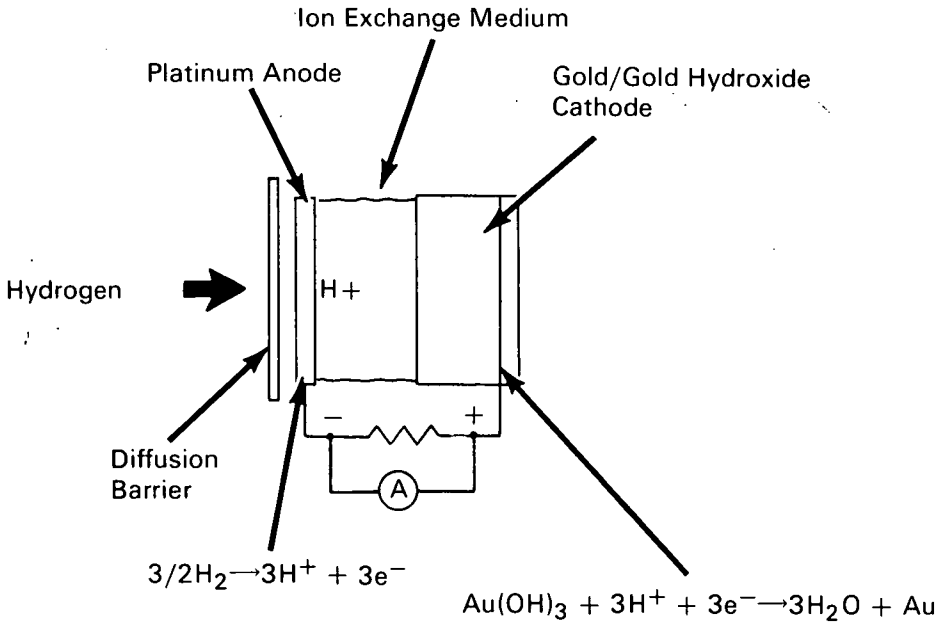
NASA TECH BRIEF

Improved Fuel-Cell-Type Hydrogen Sensor



The conventional hydrogen sensor based on the fuel cell principle requires a continuous supply of gaseous oxygen to the cathode. This need for gaseous oxygen is eliminated in a modified hydrogen sensor by replacing the oxygen cathode with a cathode consisting of a sealed paste of gold hydroxide ($Au(OH)_3$) and a pure gold (Au) current collector. The net reaction which occurs during cell operation is the reduction of the gold hydroxide to gold and water, with a half-cell potential of 1.4 volts. Ionic reactions at the electrodes are shown in the sketch.

As in the case of the conventional sensor cell, the improved cell includes a polymer diffusion barrier for the hydrogen, an ion exchange medium, and an external circuit. The current appearing in the external circuit is directly proportional to the partial pressure of the hydrogen gas at the diffusion barrier.

Advantages of the improved hydrogen sensor are:

1. A supply of oxygen gas is eliminated, thereby making the sensor considerably lighter, smaller, and less costly.
2. Sensor fabrication is simplified, since the gold hydroxide electrode is not dependent on a multiphase catalyst interface required with the oxygen electrode.
3. A low stoichiometric mass of gold hydroxide is required to sustain sensor operation.

(continued overleaf)

4. The high half-cell potential of the cathode prevents reversal from oxygen-containing diluents, thereby enabling measurement of hydrogen partial pressures independently of the diluent.

Note:

Complete details may be obtained from:

Technology Utilization Officer
Marshall Space Flight Center
Huntsville, Alabama 35812
Reference: B68-10263

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

Source: M. D. Rutkowski and F. P. Rudek
of General Electric Company
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