NASA TECH BRIEF

Ambient Temperature Catalyst for Hydrogen Ignition

The problem:

Numerous situations exist where the generation of gaseous hydrogen presents a fire or explosion hazard. Among these are the various electrochemical processes which release hydrogen at the cathode, such as in electroplating, chemical machining, electric discharge machining, battery charging, etc. Also in the organic processing field, hydrogen is produced and liberated during fermentation and in some distillation processes. Such hazardous situations could be alleviated by causing the hydrogen to burn immediately as it enters the atmosphere.

The solution:

An ambient temperature, low-cost, catalyst for reacting hydrogen gas with air in a catalytic cell near the point of evolution at a controlled rate.

How it's done:

This innovation represents a "new use" for a catalyst developed for the petroleum industry. A survey of commercially available metal oxide catalysts, supported by empirical evaluations of the most promising, lead to the selection of a catalyst consisting of ferric oxide (Fe_2O_3) impregnated in small silicon carbide cylinders 3/16-inch in diameter by 3/16-inch long.

This catalyst in pellet form is loosely packed (random orientation) between screen barriers in a duct. As the mixed gases, hydrogen and oxygen, pass through the catalyst bed, the iron oxide promotes reaction in the combustible gas mixture, increasing the temperature to the normal ignition point where the reaction becomes self-sustaining. The catalyst provides a surface area of 0.3 m^2/gm. A bed one inch in diameter and five inches long was found to be satisfactory with gas flows of less than 4 lb/sec.The catalyst was found to perform reliably in the ambient range for oxygen/hydrogen mixture ratios from 0.5 to 170:1 in actual application. Laboratory tests at mixture ratios from 0.33 to 48:1 gave approximately 60 percent of theoretical activity. Dilution for these tests was with nitrogen, closely simulating air/hydrogen mixtures in some cases.

Notes:

1. As an accessory for vent stacks for hydrogen storage tanks, piping systems, and transport vehicles, the catalytic cell can assure reaction before a hazardous concentration can accumulate.
2. A catalytic cell would be a very useful standard accessory for laboratory fume hoods where hydrogen accumulation can frequently reach hazardous conditions.
3. Documentation for the innovation is available from:

   Clearinghouse for Federal Scientific
   and Technical Information
   Springfield, Virginia 22151
   Price $3.00
   Reference: B68-10520

Questions concerning this innovation may also be directed to:

Technology Utilization Officer
Lewis Research Center
21000 Brookpark Road
Cleveland, Ohio 44135
Reference: B68-10520

Patent status:

No patent action is contemplated by NASA.

Source: Robert W. Roberts
of North American Rockwell Corporation
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