NASA TECH BRIEF

Ames Research Center

Low Temperature Catalytic Ignition of Hydrogen and Oxygen

The problem:

To ignite mixtures of hydrogen and oxygen at temperatures as low as 78°K where the usual catalyst compositions fail to react.

The solution:

A catalyst containing iridium.

How it's done:

A catalyst composed of 32% iridium metal supported on granular alumina was found to be the most active and most stable of a large variety of candidate platinum metal catalysts. The catalyst consistently induced reactions at temperatures as low as 78°K in hydrogen-rich oxygen mixtures but after being allowed to remain 15 minutes at 1200°C in a hydrogen–15% steam mixture, its lowest temperature of activity was only 136°K.

This catalyst is prepared by a special process, but some other catalysts seem to be as effective after cycling to 1200°C in a hydrogen–15% steam mixture; for example, 9.2% platinum with 4.8% ruthenium on a "superpure" alumina support (barely active at 102°K before cycling). A wide variety of platinum–ruthenium catalysts were found which could cause ignition of hydrogen and oxygen at 143°K or above.

Of particular interest is the fact that these catalysts are active at low temperatures in highly dilute mixtures, for example, 3% hydrogen and 1% oxygen in helium at atmospheric pressure and 78°K for a 32% iridium catalyst. Catalytic combustion is possible with mixtures that are not in the flammable region, that is, the mixtures cannot be ignited by sparks.

Notes:

1. Unfortunately, these catalysts must be kept scrupulously clean and prereduced with hydrogen. The most active catalysts must be kept in hydrogen or vacuum before use. If the catalysts get too hot during use or are not cooled in hydrogen, they lose much of their effectiveness.
2. The following documentation may be obtained from:

   National Technical Information Service
   Springfield, Virginia 22151
   Single document price $3.00
   (or microfiche $0.95)
   Reference: NASA CR-100251 (X69-13381), Hydrogen-Oxygen Ignition at Low Temperatures.
3. No additional documentation is available. Specific questions, however, may be directed to:

   Technology Utilization Officer
   Ames Research Center
   Moffett Field, California 94035
   Reference: B72-10127

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to:

Patent Counsel
Mail Code 200-11A
Ames Research Center
Moffett Field, California 94035

Source: Hervey H. Voge, Thomas J. Jennings, and Warren E. Armstrong of Shell Development Company under contract to Ames Research Center
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