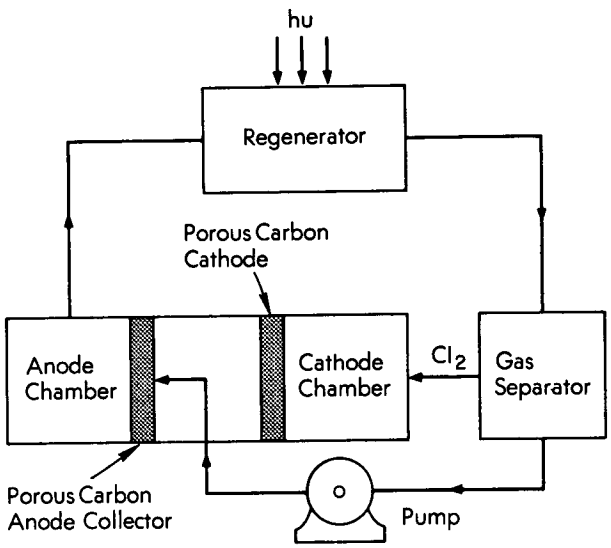
NASA TECH BRIEF

Ames Research Center

Silver-Chlorine Fuel Cell — A Concept

The problem:

To construct a silver-chlorine fuel cell which is regenerated by photochemical reduction; one of the complications is that silver particles must be effectively circulated and made available for reaction.



The solution:

A novel slurry system which enables transport of particles of reduced silver between the regenerator section and the anode.

How it's done:

The fundamental reaction which provides electrical power from the type of fuel cell shown in the diagram is:

$$2\,Ag + Cl_2 = 2\,AgCl.$$

The central compartment of the fuel cell contains a slurry of silver chloride (AgCl) and silver particles, and chloride ion as provided by a suitable electrolyte. The main stream of the pump which handles this slurry is directed toward the porous carbon anode collector; additionally, the pump also evacuates the anode chamber. As a result, the slurry handled by the pump is caused to pass through the porous carbon anode collector. Silver particles in the slurry come into contact with the carbon anode structure and the following reaction takes place when power is withdrawn from the cell:

$$Ag + Cl^- = AgCl + e^-.$$

The silver chloride that is formed in the anode structure is a solid, but it is removed and carried along in the main stream of slurry. In due course, the silver chloride enters the regenerator where it is reduced by light (as in photographic processes):

$$2\,AgCl = 2\,Ag + Cl_2.$$

The slurry stream flowing out of the regenerator now contains bubbles of chlorine gas as well as particles of silver and unreduced silver chloride; the chlorine gas is removed by a separator and conducted to the cathode compartment. The chlorine gas permeates the porous carbon cathode structure and when power is withdrawn from the cell, the following reaction takes place:

$$Cl_2 + 2e^- = 2\,Cl^-.$$

The handling of slurries in fuel cells has been studied in detail in more complex systems involving hydrogen, oxygen, and solid catalysts. The mechanical details of systems for circulating slurries are fairly well established.

(continued overleaf)

Notes:

1. The following documentation may be obtained from:

   National Technical Information Service
   Springfield, Virginia 22151
   Single document price $6.00
   (or microfiche $0.95)

   Reference:
   NASA CR-94407 (N68-22889), Feasability Study of High Performance Hydrogen-Oxygen Fuel Cells.
2. Regeneration of silver chloride may also be effected by chemical means, for example, by the compounds ordinarily used as photographic developers or strong reducing agents such as hydrazine.
3. No additional documentation is available. Specific questions, however, may be directed to:

   Technology Utilization Officer
   Ames Research Center
   Moffett Field, California 94035
   Reference: B72-10221

Patent status:

No patent action is contemplated by NASA.

Source: Martin Lieberman of
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