What is the fusion torch

With the advent of fusion energy a new technology comes on line for materials processing known as a fusion torch. By exposing materials to the temperatures attainable in a fusion plasma—in the range of tens to hundreds of millions of degrees centigrade—any atomic species can be ionized, have one or more electrons removed from it, leaving it in a charged state. In the presence of electric and magnetic fields, this ionized material can be separated or combined to produce chemically pure materials or fabricate the desired compounds.

The torch uses the high temperature plasma generated in a fusion reactor, preferably of a cylindrical rather than a toroidal configuration. The reactor need not be a net energy producer, but simply capable of sustaining a fusion burn. Part of the plasma is shunted out of the reactor in such a way as to avoid transmission of neutron radioactive contamination, and the material processing occurs in a separate chamber where the plasma is collected.

The implications of this technology are enormous for the potential expansion of natural resources. With the fusion torch and cheap, abundant energy, mining of low grade ore, unfeasible with conventional techniques, is made possible.

It has been estimated that ore processing using the fusion torch can be economically competitive with present methods, even extracting elements from dirt. One of the striking results of this kind of processing is that aluminum, significantly more abundant than iron but more expensive to produce, would become relatively inexpensive and could replace many uses iron now fulfills.

In addition, large amounts of ultraviolet and x-ray radiation can be produced in desired frequency ranges. This energy could be applied to photolytic chemical processing, a technology still to be developed.

Although the concept of the torch has been in existence since the 1960s, there has been only a small amount of theoretical work done to date, and no experimental work.

A crash development program, testing both the magnetic switching and the plasma centrifuge concept for materials separation and the various possibilities for photolytic chemistry should make it possible to add this technology to the industrial arsenal even before the achievement of commercial energy production using pure fusion devices.

recommended that a panel of leading scientists, engineers, and industrial experts be convened to make recommendations to Congress on the organization, structure and funding of an accelerated fusion program to begin in fiscal 1982.

Such a panel has been convened by Rep. Mike McCormack (D-Wash.) who noted in announcing the formation and goals of the panel on June 26: "Nuclear fusion has the greatest potential of any advanced energy technology. If offers a literally inexhaustible and practical energy source—all the energy that mankind can use for all time. Our goal is to have the first commercial demonstration fusion plant on line by the year 2000."

The panel, led by Dr. Robert Hirsch of Exxon Research and Engineering Company, includes scientific and industry experts: Dr. Fowler of Lawrence Livermore Lab, Dr. Furth of the Princeton Plasma Physics Lab, Dr. Trivelpiece of Science Applications, Inc., Robert Smith, chairman of the Board of Public Service Electric and Gas, and Dr. Tihiro Ohkawa from the fusion division of General Atomic Company.

At hearings and closed door deliberations on July 10 and 11, the panel considered recommending a significant increase in fiscal 1980 appropriations for fusion and a 50 to 100 percent increase in fiscal 1981. Rep. McCormack has recommended a $500 million fusion program by FY81.

The fusion budget

To get the nation back on the track as a world leader for growth and development requires nothing short of an Apollo Project centered around fusion research. The nuclear energy development program proposes a total fusion budget of over $6 billion for fiscal year 1981. The bulk is allocated for alternative magnetic fusion systems, and $1.5 billion for inertial confinement research.

These figures are based on past studies done by the Fusion Energy Foundation, updated for 1980 dollars, and on the actual fusion funding in the past three years. The primary source for the magnetic confinement program is the detailed Energy Research and Development Administration study, *Fusion Power by Magnetic Confinement Plan*, Vol. 1-4, ERDA 76/110 (July 1976).

These budget figures for magnetic confinement were