Closed-Loop Circulation Solid Fusion Heater

We now describe a self-stimulated developmental cold fusion heater that makes use of a closed-loop deuterium circulation system driven by a pair of solid-electrolyte fuel-cell based electrolysis cells. The inflow cell drives circulation, and the outflow cell either drives or impedes deuterium circulation under operator control. The concept heater uses an assembly containing a metal reactor plate interfaced with either one or two solid-electrolyte layers. The assembly is mounted inside a gas containment enclosure pierced with hermetically sealed electrical feed-through fittings. The enclosure is filled with deuterium gas D_2. The containment enclosure contains a metal reactor plate capable of absorbing deuterium. During heat generation operation it is subject to the diffusion flow of deuterium in response to an internal deuterium density gradient. The reactor plate is fabricated so as to contain internal layers of metal oxide in contact with sputtered Pd and oriented parallel to the plate's surface, and of construction such that the layers impede, but do not prevent deuterium diffusion flow within the reactor plate. The two exterior faces of the reactor plate are each coated with a solid state electrolyte. Each solid electrolyte layer is overcoated with a metal foil which is capable of dissolving deuterium. Metal foil, solid electrolyte, and contacting surface of the reactor plate form an electrolysis cell. There are two cells. There is an inflow electrolysis cell through which deuterium flows before entering the reactor plate, and an outflow electrolysis cell through which deuterium flows after leaving the reactor plate. The rims of the reactor plate, the two electrolyte layers, and the two metal foils are coated with an electrical insulator, which constitutes an annular rim insulator. The annular rim insulator is penetrated at the metal plate's rim with an electrical conducting wire, which passes through a feed-through fitting that penetrates the containment vessel wall so as to permit connection to an external source of voltage and current outside the containment enclosure. Separate electrical wires make contact with the two metal foils, and pass through the wall of the containment enclosure through separate metal feed-through fittings. All wire passages through the walls of the containment enclosure are vacuum-tight sealed. A hermetic gas input tube penetrates the containment enclosure wall. The input tube is used to introduce deuterium gas into the cell during a preparation period during which a desired initial quantity of deuterium dissolves into the various metal components and a desired initial quantity of deuterium gas fills the containment enclosure. The gas input tube can be sealed off before the process operation. The concept cell is shown in Figure 2.10,1.

During the process operation, deuterium gas is absorbed into the positive electrode of the inflow electrolysis cell. The absorbed deuterium converts into ion form, then passes through the front electrolysis cell and enters the front layer of the reactor plate, flows through the reactor plate where a portion is subject to conversion to quasiparticle form at internal

CaO-palladium interfaces, then mostly passes out the back surface of the reactor plate into the outflow electrolysis cell with its covering metal foil, and re-enters the gas volume of the containment enclosure as deuterium gas. It thereby completes a closed-loop circulation path. This deuterium circulation is driven by serial voltage potentials applied across the inflow and outflow electrolysis cells. The interface flow process converts some of the diffusing deuterium into a nuclearly active configuration. As described in THEORY, paired deuteron quasiparticles undergo exothermic cold fusion reactions. Released nuclear energy converts into heat within the reactor plate. Subsequent heat transfer flow delivers the generated heat to a user application.

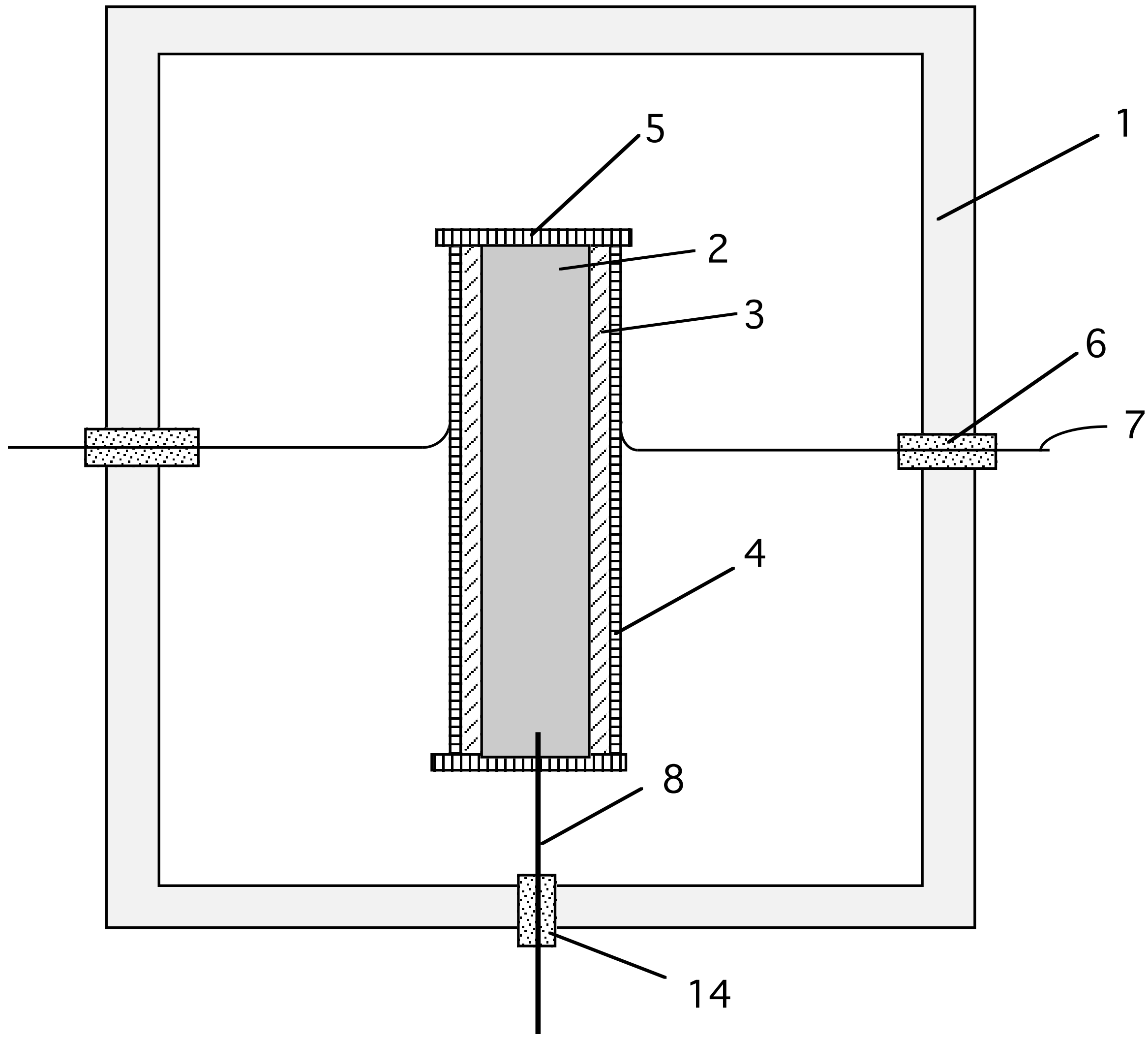

Fig. 2.10,1. Concept drawing of a closed-loop cold fusion heater that generates heat from closed-loop circulating deuterium gas. The closed-loop heater uses a permeation process employed by Iwamura *et al.* in studies reported in 1999. It also operates at higher deuterium chemical potential (effective pressure), and can make use of ionic solid-nanometal composites pioneered by Arata and Zhang. Item 1 is a pressure tight enclosure, Item 2 is a cold fusion reactor plate containing inclusions that provided ionic oxide-nanometal interfaces, Left and right items 3 are solid electrolyte layers, and Left and right items 4 are metal foils that cover and make contact with the solid electrolyte layers. Item 5 designates a gas tight, insulating surface. The inflow metal foil converts D_2 gas into D^+ ions, and the outflow metal foil converts D^+ ion into D_2 gas, completing a closed-loop circulation flow. Cold fusion occurs in the ionic solid-nanometal interfaces where deuterium is present in a quasiparticle geometry.