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The Nucleovoltaic Cell

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Described in this paper is a cold fusion device that is conceptually designed to convert the energy release, from deuteron-deuteron fusion, directly to electricity at an efficiency worthy of commercial development. The working element is an N-type semiconductor which has been coated with a thin film (a few hundred angstroms) of hydrogen-active metal, for example palladium, and which is joined to a P-type semiconductor at the PN-junction. The working element is not an "electrode," as such, but an "electron pump."

During operation, deuterium gas is absorbed into the interface between the thin metallic layer and the N-type semiconductor. Excess electrical energy and voltage result from the d+d fusion reaction, as electrons in the N-type semiconductor are promoted to higher energy from the valence band to the conduction band. This new phenomenon of converting nuclear energy directly to electricity is termed "the nucleo-electric effect."

The electronic schematic of a possible commercial nucleovoltaic cell is shown on the next page. Of course, the first proof-of-concept experiments will emphasize fabrication and design of the semi-conductors used in the cell core.

Cell Design

Pressure-strong inner vessel (1) contains D₂ (or H₂) gas. A P-type semiconductor (2) has an NP-junction (3) with the N-type semiconductor (4) that has been coated with a thin film of hydrogen-active metal (e.g. Pd, Ti, or Ni). Electrical contacts (5) connect the semiconductors to the external load (6) as well as to a rechargeable battery or energizer (7), in series with two ohm resistors (8,9), and a parallel circuit consisting of a heating coil (10). Deuterium or hydrogen gas is admitted to the evacuated vessel (1) through valve (11). The gas pressure will be made above atmospheric.

During the startup phase of cell operation, the internal switch (12) is closed, while the external switch (13) is open. The energizer (7) provides a forward-biased voltage across the NP-junction (3) greater than the contact potential set up in the reverse direction (P to N). A certain current is generated through the energizer circuit - from point A to N to P to B, and is limited by the total resistance, $R_7 + R_8 + R_{NP} + R_9$. A larger current is passing through the solenoid, which is intended to heat the hydrogen gas (to help gas absorption into the N-type) and create magnetic lines of force along the NP-core, which will assist alignment of deuteron or proton chains. [Chains of deuterons or protons are the "reacting species" in my cold fusion theory, called Mechanisms of a Disobedient Science - see Infinite Energy #28, 1999.]

During startup, a PN-type rectifier (14) assures electron flow in the direction indicated, avoiding any "electron backup" going from N to D to B. Also, during this phase, parameters of gas temperature and pressure will have to be made sufficient to enable D or H to absorb into the interface between the thin metallic film and surface of the N-type semiconductor. There, deuteron-deuteron fusions (or proton-proton-electron fusions) energize electrons in the N-type, driving them across the junction to fill electron holes in the P-type. Thus, the N-type becomes more and more positively charged and the P-type more negatively charged.

Cell Output Phase

As fusion reactions occur during the startup phase, eventually voltage across NP (where P is negative and N is positive) increases until $V(\text{at C}) > V(\text{at A})$. At point C, electron current divides, with some e^- flow going to point A, and, when switch (13) is closed, to the external negative terminal (15) fitted on the outer housing (16), then through load (6) to the positive terminal (17) of the device.

Concerning the internal circuit during the cell output phase, electron flow from C to A will divide into three parallel branches at point A: from A through R8 to N, from A through solenoid to B through R14 to D to N, and from A through R7 to B through R14 to D then to N. The latter is the recharging cycle for the battery or energizer (7). Resistor (8) is needed in the circuit to limit a "bleeding off" of electrons from P to C to A to N, allowing more current to pass from A through R7 to B to D to N.

Also during operation, current through the solenoid branch, that is from P to C to A through coil to B through R14 to D to N, is now limited by R14. During cell operation, some excess heat undoubtedly will come from the fusion reactions (i.e., not 100% conversion to electricity) so less electron flow through the heating coil is desired.

One additional circuit is noted during cell output: from P through R9 to B, then through R14 to D to N. I believe resistor (9) is needed to guarantee a voltage drop from P to B, so that $V(\text{at B})$ is less than $V(\text{at A})$ - a necessary condition for proper electron flow through the internal circuits during cell output phase. If it happens that reactions in the N-type semiconductor fall below the minimum operational rate, then $V(\text{at C})$ becomes less than $V(\text{at A})$, and battery (7) re-energizes the cell.

Choosing the correct components for the Nucleovoltaic cell, including the best ohm rating for resistors (8) and (9), can lead to a reliable*, rugged, self-sustaining and long-lasting source of direct current for many applications.

*Individual cells might produce varying direct current, but cells in combination should generate a steady current, and current of increased amperage.

- 1 Pressure-strong vessel
- 2 P-type semiconductor
- 3 NP junction
- 4 N-type semiconductor
- 5 Electrical contacts
- 6 External circuit load
- 7 Rechargeable battery or energizer
- 8 Resistor
- 9 Resistor
- 10 Solenoid (heating coil)
- 11 Valve
- 12 Switch, internal
- 13 Switch, external
- 14 PN-type rectifier
- 15 Negative terminal of NV cell
- 16 Outer housing
- 17 Positive terminal of NV cell

