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CRACK-FUSION : A PLAUSIBLE EXPLANATION OF "COLD FUSION"

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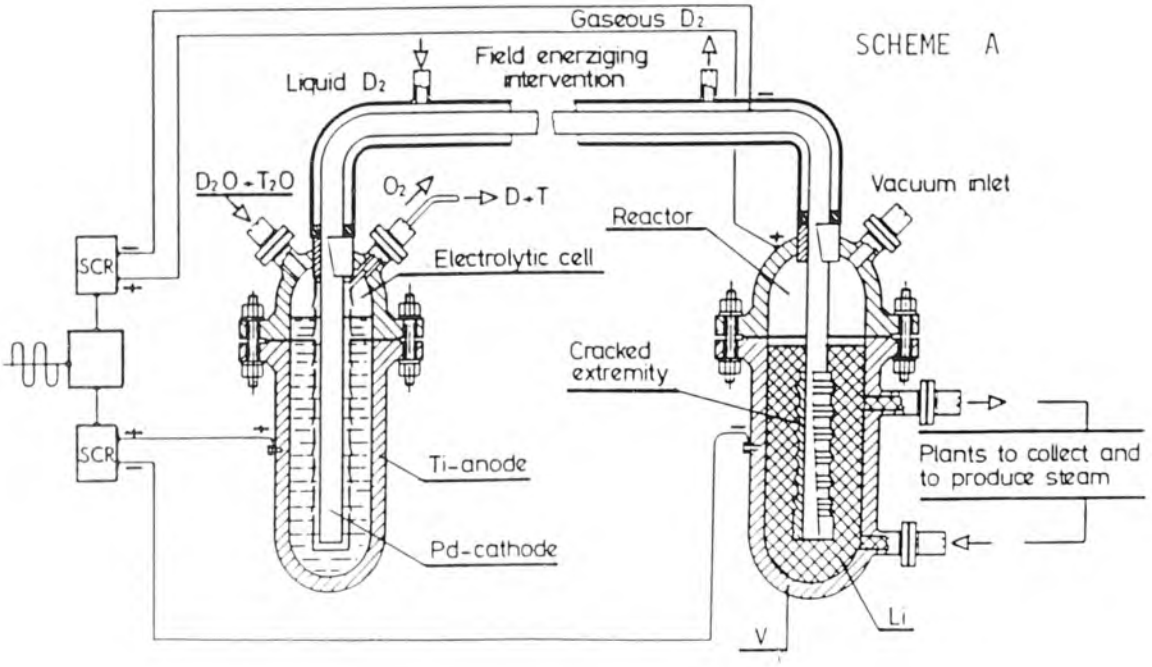
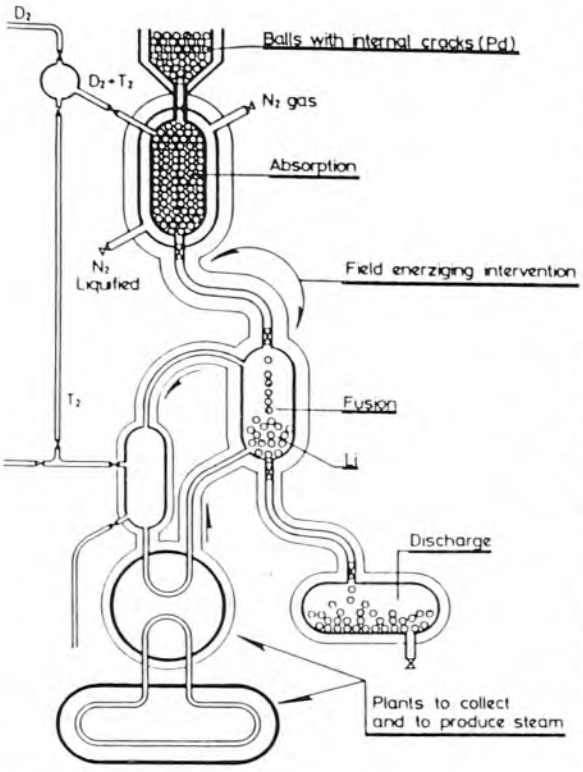
Plausible dynamics are herein hypothesized on "cold fusion" in readily absorptive metals, such as Palladium or Titanium, for Hydrogen and its isotopes, the absorption at a high density level by these metals of mixtures of said isotopes (especially Deuterium and Tritium) and their successive liberation within internal cracks of the metal mass where pressures exceeding 10^{12} atm are expected to be created such that they generate fusion phenomena in accordance with the probable explosive sequence as follows: the formation of molecules, the increase in pressure, the formation of plasma, nuclear fusion.
Based on the formulated theory of "crack-fusion", a process is foreseen with relevant plants and devices for "controlled cold nuclear fusion" or "cold fusion" which envisages the absorption, at a high density level, of Deuterium atoms or their mixtures with Tritium or Helium by readily absorptive metals, such as Palladium or Titanium, for Hydrogen and its isotopes, and their successive liberation within quenching cracks, cracks due to plastic deformation, intercrystalline or transcrystalline micro-cracks or any micro-discontinuities present within and among crystals, created within the metal mass by metallurgical or mechanical means or in any other possible way. The strong influx into said cracks or micro-discontinuities of self-liberating Deuterium or Deuterium-Tritium atoms create such high pressures (practically between 10^{12} and 10^{24} atm) that their nuclei interfuse.
Deuterium and mixtures thereof with Tritium or Helium are brought into contact with the absorptive metal surfaces either by the cathodic polarization of said surfaces during the electrolysis of pure heavy water, or heavy water containing Tritium and Helium; or, alternatively, through physical contact with Deuterium or mixtures thereof with Tritium or Helium, both in a pressurized gaseous state.
It is foreseen: that this absorption occurs in the very same zone, as

that of the metal element, which contains micro-discontinuities and therefore where fusions among the liberated nuclei occur; or - on the assumption according to which nuclear fusion phenomena among Hydrogen isotopes generally take place only within micro-discontinuities in the metal masses- on the one hand, that the absorption occurs in an absorptive zone of the metal element devoid of cracks or any internal micro-discontinuities and, on the other hand, that the liberation occurs in another zone, contiguous to or distant from the former, which has to bear cracks or internal micro-discontinuities within its metal mass or pseudo-cracks between said metal element and another similar or dissimilar metal, endowed with a greater or lesser absorptive capacity, and which forcefully encompasses the former.
Furthermore, intervention with electric fields, electromagnetic fields, radiation, laser beams or particle accelerators is foreseen for the energizing of the absorbed nuclei so as to increase their flow-velocity within the metal element and the kinetic energy acquired by said nuclei during the liberation stage.
The process herein described also foresees, especially so whenever the absorption of Deuterium or mixtures thereof with Tritium and Helium is effected in gaseous phases, that the absorptive metal is subjected to temperature variations and that this absorption occurs when the metal is brought to a low or an extremely low temperature - approximately -200 C; that is, under the conditions of contraction or maximum contraction of the metal so that the micro-cracks are compressed or extremely compressed as a consequence.
When the temperature is raised once more, the resultant expansion of the metal causes the dilation of the micro-cracks, micro-cavities and discontinuities within which the atoms of Deuterium of mixtures thereof with Tritium or Helium are drawn with the consequential occurrences of nuclear fusions.
Finally, it is foreseen that the liberation phase, in any case, occurs directly within the molten lithium.

Schemes A and B show two possible plant realizations, for the production of vapour and therefore electrical energy, which constitute the same practical applications of the plausible C R A C K FUSION dynamics.



SCHEME B



radio-frequency signals, photons and charged particles during the fracturing of deuterated Titanium.

PHENOMENA KNOWN PRIOR TO "CRACK-FUSION"

Hydrogen, absorbed in an atomic state by steel during welding or electrochemical processes, is liberated within cracks, transformed into a molecular state thus creating pressures exceeding 10^7 atm which, in turn, give rise to "blistering" (Fig.1) and/or "internal cracking" (Fig.2). A particular case of "blistering" is the type (Fig. 3) between an enamel layer and a steel surface.

Analogous phenomena, occuring through the liberation of atomic Hydrogen from an electrolyte thus passing into a molecular state with an increase in volume, are those termed "Cathodic Disbonding" (Fig.4) i.e; the detachment of coatings from interred pipelines under cathodic protection; and that termed "Crevice Corrosion" (Fig.5) which occurs within external cracks of metal elements in the presence of an oxygenated electrolyte within the crack tip. Also extremely interesting is "Fracto-Emission" as described by certain authors; the emission of

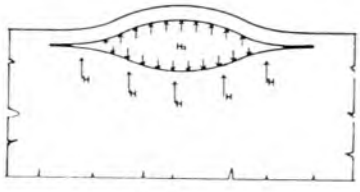


Fig.1

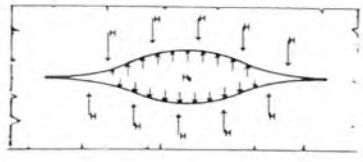


Fig.2

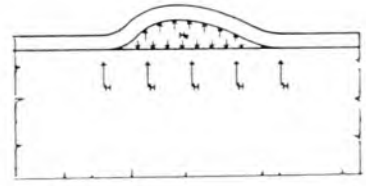


Fig.3

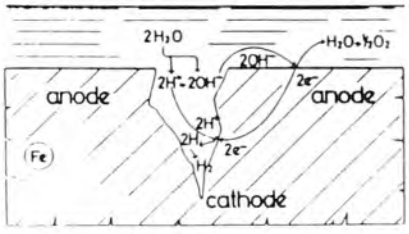


Fig.4

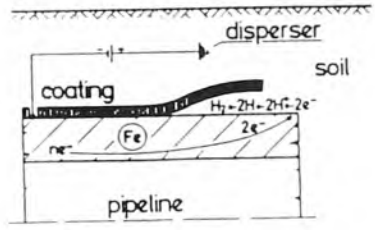


Fig.5

A POSTERIORI CLUES TOWARDS THE RELIABILITY OF "CRACK-FUSION"

GENERAL DIFFICULTIES WITH THE REPETITION OF "NUCLEAR FUSION".

Obtaining positive results with nuclear fusion seems to depend on having internal cracks within the Palladium or Titanium cathode or cracks created by plastic deformation after long charging.

THE DIFFICULTY WITH REPEATING FUSION ON THE SAME METAL UNDER THE SAME WORK CONDITIONS.
This difficulty is supposed to be caused by the entrapment of fusion products within the crack.
Sporadic repetitions experienced by certain researchers may be attributed to crack advancement and relative volume increase.

AN EXPERIMENT BY PROF. SCARAMUZZI
The Titanium shavings have most likely and largely favoured the positive outcome of the experiment since metal shavings naturally present numerous internal and external cracks. The repetition, at close frequency, of the fusion may be related to easier advancement and revitalizing of cracks within the shavings.

FRACTO-EMISSION
"FRACTO-EMISSION" has been hypothesized by certain researchers - see under (*) - prior to the event of "COLD FUSION".
Subsequently, in No. 1 dated January 1990 of the Materials Research Society an article appeared by the authors Dickinson, Jensen and others under the heading "Fracto-emission from Deuterated Titanium; Supporting Evidence for a Fracto-fusion Mechanism".
In this very interesting article the hypothesis we illustrate in Fig. 6 is postulated.
That is "that crack growth results in charge separation on the newly formed crack surfaces, which act like a miniature "linear accelerator"; i.e. D+ ions are accelerated in the electric field across the crack tip to kinetic energies of $10-10^4$ eV or more, sufficient to raise the D+D fusion probability".
We instead assume that also in the case of Deuterated Ti or Pd there is an occurrence of D + D fusion in accordance with the dynamics illustrated in Fig. 7 as hypothesized by us.
Here too it is a case of a fusion process resulting from the liberation of Deuterium atoms within the tip of an external crack.

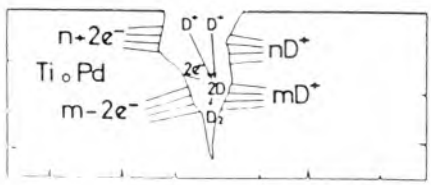


Fig.6

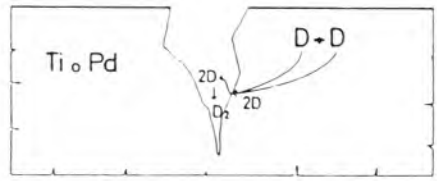


Fig.7

* J.T. Dickinson, E.E. Donaldson, and M.K. Park, "The Emission of Electrons and Positive Ions from Fracture of Materials" J. Mater Sci. 16, 2897-2908 (1981)
J.T. Dickinson L.C. Jensen, and A, Jahan-Latibari, "Fracto-Emission : The Role of Charge Separation", J.Vac.Sci.Technol. A2, 1112-1116 (1984)
J.T. Dickinson, W.D. Williams, and L.C. Jensen, "Fracto-Emission from Lead Zirconate-Titanate", J.Am. Ceram.Soc.68, 235-240 (1985).

Italian Patents of 14.06.1989 and 26.02.1990 extended to the European Community and thirteen other Extra-European States.