ANOTHER EXPLANATION OF PIPE RUPTURE INCIDENT AT HAMAOKA NUCLEAR POWER STATION UNIT-1 FROM VIEW POINT OF COLD FUSION

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Abstract: An extraordinary powerful explosion took place at the Hamaoka nuclear power station unit-1 of Chubu Electric Power Company in Nov. 2001, resulting in a pipe rapture of the steam condensation line of the residual heat removal system. The cause of the incident is said to be hydrogen explosion, namely, combustion of stoichiometric mixture of hydrogen and oxygen accumulated in the residual heat removal (RHR) system. Intensive research works have been carried out to reconstruct this strange combustion phenomenon but it seems the reports failed to explain this anomalous combustion. Randell Mills developed "BlackLight Process" starting in 1986 that can explain excess heat in the absence of nuclear products in the research of cold fusion. It was reported [1] that there exist several anomalous combustion phenomena which can not be explained by current theories but can be explained by the BlackLight Process. The Black Light Process was applied to this incident and it was shown that the BlackLight Process can explain the pipe rapture incident at Hamaoka Nuclear Power Station more clearly.
Key words: hydrogen explosion, high concentration of hydrogen and oxygen, Hydrino

1. INTRODUCTION

An extraordinary powerful explosion took place at the Hamaoka nuclear power station unit-1 of Chubu Electric Power Company in Nov. 2001, resulting in a pipe rapture of the steam condensation line of the residual heat removal (RHR) system. Intensive research works have been carried out to reconstruct this strange combustion phenomenon and the final report was published. The cause of the incident is said to be hydrogen explosion, namely, combustion of stoichiometric mixture of hydrogen and oxygen accumulated in the RHR system. A close examination of this report revealed that there were a couple of wrong assumption in the calculation of gas generation process during steam condensation and another explanation is needed.

2. PIPE RAPTURE MECHANISM

According to the report prepared by Nuclear and Industrial Safety Agency (NISA), Ministry of Economy, Trade and Industry (METI), JAPAN, the mechanism of pipe rapture can be illustrated as is shown in Fig.1 and can be summarized as follows [2].

(1) The main steam contains hydrogen and oxygen generated by radiolysis of reactor water. The RHR steam condensation line at Hamaoka-1 features a very long and upward pipe with the dead-end section. In such a piping layout, a temperature gradient is produced throughout the piping system. Therefore, the steam condensation by heat release from the pipe allows non-condensable gas to gradually accumulate at the upward dead-end pipe section and the separation takes place between high-temperature steam region and low-temperature non-condensable gas region. The results from the experiments and the analyses showed that non-condensable gas had accumulated in the upward dead-end pipe section (about 7-m length from the holdup water surface in the pipe).

(2) The hydrogen combustion might have been caused by the pressure transient induced by the inflow of high-temperature steam to non-condensable gas region, due to the opening of the valve for the periodical inspection. It is possible that the noble metals attached to the inner surface of pipe acted as a catalyst.

(3) The ignition of non-condensable gas was followed by its combustion that propagated toward downstream and shifted from normal combustion to detonation. Pressure in the pipe increased rapidly in the meantime, causing the rupture of the elbow containing the holdup water.

3. ACCUMULATED GAS CONTENTS

Chubu Electric Company has been operating 4 nuclear power plants at Hamaoka. The unit-1 (in which the incident took place) and unit-2 are boiled water reactor and have a very similar operating history including injection of hydrogen and noble metal catalysts into cooling water to prevent stress corrosion cracking of internal parts made of steel alloy. After the incident, non-condensable gasses of the unit-2 that were accumulated at the upward dead end of the pipe

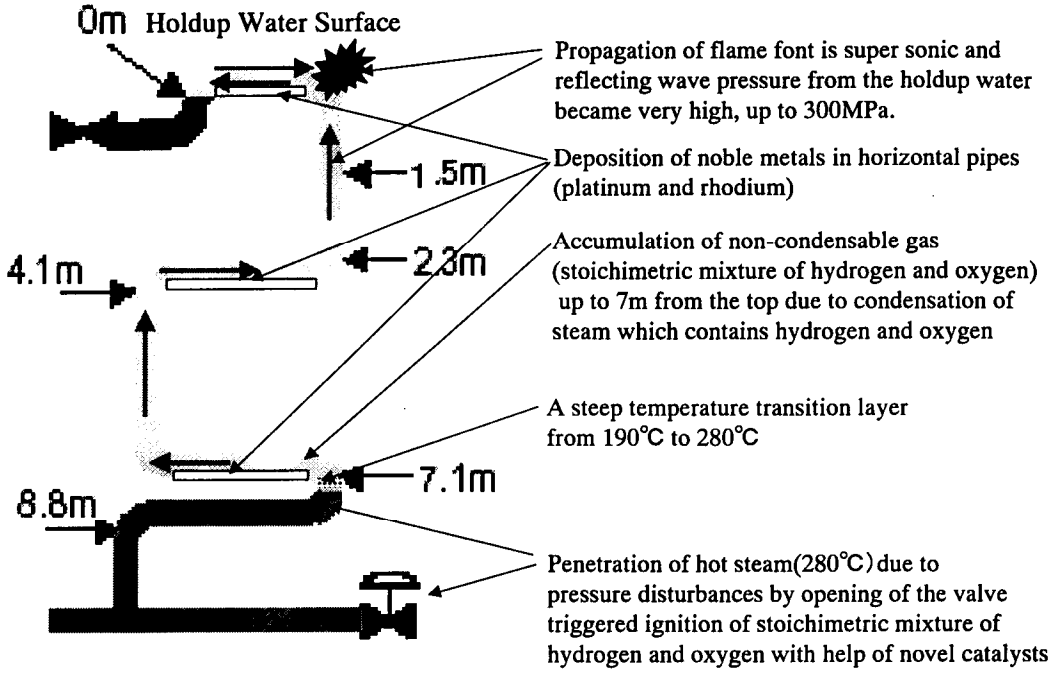

Fig. 1 Mechanism of hydrogen explosion according to Chubu Electric Company

	A: Residual gases from previous cycle ***Initial condition***	**B: Calculated gas generation by Chubu**	**C: Calculated gas contents in pipe by Chubu**		**D: Measured Gases**	**E: Calculated gas generation based on A&D**
Gases	mol	mol	mol	%	%	mol
Hydrogen	0	**63.7**	63.7	**41.9**	**45.1**	**62.29**
Oxygen	11.9	**31.9**	43.8	**28.8**	**22.5**	**19.15**
Nitrogen	44.7		44.7	**29.4**	**32.4**	
Sum	56.6	95.6			100	81.44

Table 1 Gas contents in the pipe

were taken and its contents were measured. Also, the company carried out the calculation of non-condensable gas generation by computer simulation program and confirmed the validity of the simulation program using a test rig similar to the existing pipe. But it should be noted that amount of gasses thus calculated depends on the initial assumption how much the concentration of hydrogen and oxygen are in the steam. The table 1 shows mol and percentage of hydrogen and oxygen that were calculated and also measured on the unit-2.

Column A is the carried over gasses in mol from the previous cycle
Column B is the gasses in mol calculated by computer simulation program
Column C is the combination of A & B which the company thought were present in the pipe.
Column D is the measured gas concentration in percentage.
Column E is the gas quantity required to have Column D, starting from the initial condition of Column A.

4. QUESTIONS ON THE CLAIMS BY CHUBU ELECTRIC COMPANY

Chubu Electric Company claims that its calculation results of hydrogen and oxygen in % in C are generally in agreement with measured one (D). But if we compare the hydrogen contents of 41.8% in C with 45.1% of the measured one in D, the difference is minus 3.2%. On the other hand, if we compare the oxygen contents of 28.8% in C with 22.5% of the measured one in D, the difference is plus 6.3% and its direction of the differences is opposite to the case of hydrogen. The quantity of hydrogen and oxygen in C calculated by Chubu is decided by the initial assumption how much hydrogen and oxygen are contained in the hot steam. Chubu assumed that the concentration of hydrogen and oxygen in the steam were 2ppm and 16ppm respectively which gives rise to the gas generation ratio of hydrogen 2 and oxygen 1, but as was shown in the above examination, this assumption seems wrong. Rather simple calculation gives hydrogen and oxygen in mol which are necessary to have the measured gases in D when started from A, as shown in E. When we compare column B with E, we can notice that hydrogen is in good agreement but oxygen is not. In other words, generation of oxygen must be much smaller than 31.9 mol in B. This suggests that Chubu assumed too much concentration of oxygen in the steam and also ignored the re-combination of hydrogen and oxygen with the help of noble metals on the pipe wall. The total gas generation in E is 81.44 mol and this is 15% less than the calculated one in B. The operating hours of Unit-1 after the previous periodical inspection to the accident is almost 2.5 times longer than that of Unit-2, it can be assumed that more re-combination of hydrogen and oxygen took place in Unit-1. This suggests that non-condensable gas in the unit-1 didn't reach 7m from the top dead end section. All these examinations put the pipe rapture mechanism by Chubu in a serious doubt and necessitate developing a new mechanism for the pipe rapture incident.

5. HYDRINO HYPOTHESIS

There are several scientists who claim that an electron with lower energy states than the ground electronic state is possible in the hydrogen atom. Randlle Mills, one of these scientists, demonstrated that hydrogen atoms can achieve lower states than ground state by a resonant collision with a near by atom or combination of atoms having the capability to absorb the energy to effect the transition, namely, an integer multiple of the potential energy of the electron at ground state of the atomic hydrogen, $m \times 27.2eV$ (m=integer) [3]. He succeeded in generating energy somewhat between chemical and nuclear reaction using several elements such as potassium and helium as catalysts to make this transition happen. He named this shrunken hydrogen atom "Hydrino" and claims that this Hydrino can be a catalyst to shrink other Hydrinos to further lower states.

6. A CATALYTIC ROLE OF OXYGEN IN ANOMALOUS HEAT GENERATION

The author postulated that atomic oxygen can be a good catalyst for "hydrinos" generation because ionization energy of hydrogen and oxygen is very close as is shown below.

Hydrogen =13.598 eV, Oxygen =13.618 eV

It can be expected that the following reactions can take place in the environment in which atomic hydrogen and oxygen can co-exist.

$O + O + H \rightarrow H[n=1/2] + 2\,O^{+} + 2\,e^{-}$ ----(1)

$H + H + O \rightarrow H[n=1/2] + H^{+} + O^{+} + 2e^{-}$ -----(2)

$H + H + H \rightarrow H[n=1/2] + 2\,H^{+} + 2\,e^{-}$ ----(3)

$D + D + D \rightarrow D[n=1/2] + 2\,D^{+} + 2\,e^{-}$ ----(4)

$D + D + O \rightarrow D[n=1/2] + D^{+} + O^{+} + 2\,e^{-}$ ---(5)

$D + O + O \rightarrow D[n=1/2] + 2\,O^{+} + 2\,e^{-}$ ----(6)

H[n=1/2], D[n=1/2] designates a hydrogen and a deuterium whose electron orbit is shrunken to 1/2 the radius of a normal one and these will be shrunken further as reactions continue. Ions and electrons thus generated will re-combine, resulting in the formation

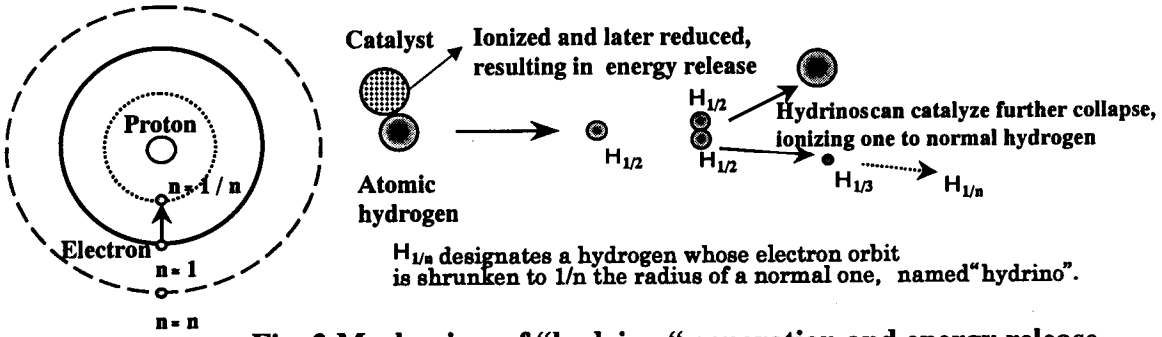

Fig. 2 Mechanism of "hydrino " generation and energy release

of oxygen as is shown in the following equation.

$2O^{+} + 2e^{-} \rightarrow 2O$ -----(7)

Then, the net reaction is :

$H \rightarrow H[n=1/2] + 40.8eV$ -----(8)

40.8eV is the energy difference of the electron at the ground state n=1 and n=1/2 state.

H[n=1/2] can be catalyst for further step as is shown in Fig 2.

It had been shown that this postulation can be applied to the explanation of several anomalous combustion phenomena that cannot be explained by current theories, such as stoichiometric mixture of hydrogen and oxygen, known as Brown's gas and air-less combustion of emulsified fuels and others[1].

It had also been shown that this postulation can be applied to the explanation of anomalous heat generation of proton conductive ceramics and nuclear transmutation induced by calcium oxide [4].

Recently, it was shown that molecule oxygen can be also a good catalyst for Hydrino generation because molecular oxygen will be undergone the following reaction[5].

$O2 + 54.4eV \rightarrow O^{2+} + O + 2e^{-}$ -----(9)

Then, the following reaction is possible.

$H + O2 \rightarrow H[n=1/2] + O^{2+} + O + 2e^{-}$ ---(10)

7. PROPOSED MECHANISM OF ANOMALOUS EXPLOSION AT THE HAMAOKA NUCLEAR POWER STATION

The steam condensation by heat release from the pipe resulted in accumulation of hydrogen and oxygen at the upward dead-end pipe section. At the surface of noble metals such as platinum and rhodium that are deposited on the horizontal part of the pipe, molecular hydrogen and oxygen will be divided into atoms. This enhances the re-combination of hydrogen and oxygen, in other words, catalytic combustion but due to the small amount of noble metals, there existed plenty hydrogen and oxygen in the upper part of the pipe. In this circumstance, there are a lot of chances for atomic hydrogen to collide with molecular oxygen and with 2 atomic oxygen simultaneously. These reactions can generate somewhat between chemical and nuclear reaction, in other words far more energy than normal combustion of hydrogen. Judging from the latest report made by the NASA funded project [6], it can be conceivable that the explosion could be strong enough to break the pipe spontaneously, because the density of hydrogen in the RHR system is over 4 order higher than that of the NASA funded project.

8. HYDROGEN EXPLOSION AT SRI IN 1992

The pipe rapture incident at Hamaoka reminds us of a very powerful explosion during a cold fusion experiment at Stanford Research Institute in 1992. At that time, there were no knowledge about the above mentioned combustion mechanism, so it is only natural to conclude the incident was just a hydrogen explosion, as long as there are no nuclear ash. But, after knowing it, it is strongly recommended to revisit this incident from a new stand point of view described in this paper.

SUMMARY

1 The Chubu's report on the incident is based on a wish-full assumption such as high concentration of hydrogen and oxygen in steam, no consideration of re-combination of hydrogen and oxygen in the RHR system, and can hardly explain the mechanism of the anomalous explosion of the pipe rapture.

2 High concentration of hydrogen and oxygen on platinum and rhodium at the top corner of the pipe was optimum condition to have Randdle Mills' BlackLight process and judging from the past successful application of this process to other anomalous combustion phenomena, it can be expected that his process can be applicable to the this incident.

3 Re-visiting the incident of explosion at SRI in 1992 from this new view point is strongly recommended.

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