Effect of Excess Heat Output for the Case of Interaction of Molecules of Different Masses

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Hydrogen dissociation and recombination is considered to be an energy transfer mechanism only. The process proposed herein may provide a promising new direction for new energy research. Theoretical explanation for high efficiency of such physical systems is proposed for the first time in the present work.

Let's calculate heat energy output resulting from recombination of one hydrogen molecule. From the Langmuir and Wood results of 1911[1] it is known that recombination of hydrogen releases some heat energy:

$$H + H = H_2 + 435\text{x}10^3 \text{ (J per gram-molecule).} \quad (1)$$

One gram-molecule is about $6\text{x}10^{23}$ molecules (Avogadro number). So, heat energy output resulting from recombination of one hydrogen molecule is

$$H + H = H_2 + 7.25\text{x}10^{-19} \text{ (J).} \quad (2)$$

Dissociation of molecular hydrogen to atomic state requires the same amount of energy E_d.

$$H_2 + E_d = H + H, \quad (3)$$

where $E_d = 7.25\text{x}10^{-19}$.

In our experiments of 2003[2] we detected some anomalies of heat output for 1,000 - 1,500K. There is the question: what is the energy of molecular motion for 500 - 1,500K? We are considering here kinetic energy of motion.

Energy can be calculated as

$$E = 1.5 \text{ kT}, \quad (4)$$

where $k = 1.38\text{x}10^{-23}$ (J/K). For T = 500K it is 10^{-20} Joule. For T = 1,500K it is $3\text{x}10^{-20}$ Joule.

The energy is too small for dissociation of molecular hydrogen (Equation 1) and the experimental facts of the low-temperature high-efficiency operation requires in-depth analysis. This analysis led us to discovery of the effect.

High temperature dissociation also seems to be unexplainable since energy of heat motion is not sufficient for dissociation. The percentage of the hydrogen dissociation was measured by Langmuir as 1% for T = 2,400K and 99% for T = 7,000K. Let's calculate the energy of molecular motion for this temperature:

T = 2,400K corresponds to $5\text{x}10^{-20}$ (J)
T = 7,000K corresponds to $1.4\text{x}10^{-19}$ (J)

This seems strange, since the energy levels are lower than $E_d = 7.25\text{x}10^{-19}$ (J). The reason for this can be deduced from the experimental facts of the present research work. It led to discovery and explanation of the effects.

First, it is essential to note that the mass tungsten molecules are much different in comparison with hydrogen molecules, therefore the phenomenon described in E.V. Alexandov's[3] invention can be applied to processes of this kind. The regularity appears in a special behavior of bodies with different masses at their elastic collision and shows that at elastic collision the energy transfer coefficient depends on the correlation of the masses of the encounter bodies. For example, Alexandov's experiments show that if a steel ball falls from some height on a steel plate, it can jump back higher than the starting point. Alexandov received a patent on this discovery (October 30, 1957). At the present time the invention is widely used in various machines of hammering action, which use this method of highly-effective energy transfer. In accordance with this method a body of small mass gets extra kinetic energy at elastic collision with a body of big mass on account of the body's inner energy transfer.

We have mentioned above that minimum efficiency was about 2,000K and then it increases. This temperature 2,000K is known as the point of boiling of tungsten oxide. So, we have to consider this aspect carefully.

The experiments were organized with a system filled with hydrogen at dew point -60°C. So, a small amount of water vapor was involved in this process. Also it is necessary to note that production methods of the experimental device assumed that surface of the tungsten filament include tungsten oxide WO_3. In this case we have to take into account the "water cycle"/oxidation of tungsten:

$$Q + W + 3H_2O = WO_3 + 3H_2 \quad (5)$$

and de-oxidation of tungsten:

$$WO_3 + 3H_2 = Q + W + 3H_2O \quad (6)$$

Let's try to find why this "water cycle" can be responsible for high efficiency of the process in the low temperature area and for pulsing mode of heating. In the temperature area between 700 - 2,000K the tungsten oxide is melting but it is not evaporated yet. So, we can assume energy transfer from hot WO_3 molecule to H_2 molecule by means of the "collision interaction" takes place for the case of oxidation (Equation 5).

The fundamental law of conservation of momentum in this case can be formulated as:

$$m_1V_1 = m_2V_2, \quad (7)$$

where m_1 is the mass of the WO_3 molecule, V_1 is the velocity of the WO_3 molecule; m_2 and V_2 are the mass and veloc-

ity of the hydrogen molecule.

What is the velocity of the hydrogen molecule after interaction? Velocity of heat oscillations can be calculated as:

$$V = (3\ \mathrm{kT/m})^{0.5}\ (\mathrm{m/sec})\ . \qquad (8)$$

This approach usually is applied for the gas state of matter but in formula shown in Equation 8. Velocity V is velocity of heat oscillations of WO_3 molecules on the surface of tungsten filament for temperatures below WO_3 evaporation.

From Equation 8, velocity V_1 is about 454 m/sec for T = 1,500K. Mass m_1 is about 3.87×10^{-25} (kg).

Let's assume that molecule WO_3 transferred all quantity of motion (the kinetic momentum) to the hydrogen molecule. Velocity of this hydrogen molecule after interaction can be calculated from:

$$V_2 = (m_1 V_1)/m_2\ . \qquad (9)$$

The mass m_2 is about 3.34×10^{-27} (kg), about 1% of m_1. Due to the fact that the difference of the mass velocity V_2 is great, for example, for T = 1,500K and we can calculate that V_2 = 52.664 m/sec.

Kinetic energy of the hydrogen molecule after collision with WO_3 of 1,500K can be calculated as:

$$\mathrm{E_k} = 0.5\ m_2 V_2^2\ . \qquad (10)$$

This energy $E_k = 4.6 \times 10^{-18}$ (J) is about six times more than energy of dissociation $E_d = 7.25 \times 10^{-19}$(J).

We can conclude that the physical system of two interacting molecules can be highly efficient in the case of collision if the molecules are of different masses and this difference is great. In other words, the mass-ratio or mass-asymmetry of interacting bodies is the "key aspect." Oscillating hot heavy molecules of tungsten can provide great velocity of easy hydrogen molecules due to the law of conservation of momentum. It is necessary to note that inertia phenomenon is involved in this process since just inertial properties are different for tungsten and hydrogen. Explanation of inertia is related with aether conception and by this way the effects of low temperature dissociation and the highly efficient operation can be explained. We can assume that the aether will lose its "heat energy" when we get additional heat energy from the recombination process. We can estimate the effect of temporal displacement and gravity anomalies.

Our estimation on energy transformation can be: electric input to provide energy of W atom about 1.4×10^{-19} (J), and we can estimate heat output after recombination of one hydrogen molecule at 7.25×10^{-19}(J). In other words, 1,400 W electric input theoretically can provide 7,250 W heat output. Other variants of the design can privide more efficiency (vapor of Hg with gas H_2 or other variants).

Sure, collision of molecules is different from the case of macro-collisions, but some macro-world mechanical analogies of this effect (paradox of two-bodies collision) were considered by other researchers and theorists. However, we suppose that for the first time the highly efficient system based on molecular mass-asymmetrical collision was designed, investigated and explained theoretically in this project by the author.

So, the "water cycle" can be used to get a highly efficient heater in the case of pulsed mode and moist hydrogen. It is necessary to determine the max quantity of water vapor. Unnecessary water vapor in the system is a critical factor since in this case all tungsten can be transformed in WO_3 and the filament will be destroyed. Also, using too little WO_3 is a mistake since it can not provide a powerful effect.

Operating temperature for this effect should be below 2,000K to prevent evaporation of WO_3. During the pause (heating is switched off) WO_3 will be de-oxidized by hydrogen and the next impulse of heating will produce new high-energy hydrogen molecules and impulse of the heat output.

Other heavy atom matter can be used for this technology instead of tungsten, if its temperature of evaporation corresponds to energy E_d that allows hydrogen dissociation and recombination, *i.e.* provide both asymmetrical collision due to the mass difference and energy transfer due to the hydrogen dissociation-recombination cycle.

From this mass-asymmetry collision effect (MAC-effect) we can explain classical hydrogen dissociation/recombination cycles for the case of hot tungsten filament. Consideration of this process is analogical to the calculation of kinetic energy above, but it is necessary to use the value of the W-atom mass instead of the WO_3-molecule mass. Realization of this method with tungsten filament can be designed for 3,500K maximum since tungsten melts with more temperature. Even in this case of 5% hydrogen dissociation, it is possible to get very high efficiency of operation since energy transfer between hot tungsten and molecular hydrogen also is based on the MAC-effect.

The method can be the basis for high-efficiency heating and energy generation. One more applied aspect is based on calculations of the velocity of hydrogen molecules that is about 50-100 km/sec. It is more than orbital velocity so this method can possibly be used for aerospace technology. It seems to be possible to design a closed system operating on this principle that uses the "water cycle" described above and a special shape of the tungsten surface. It will not be similar to the usual rocket since output of the reactive mass flow (hydrogen) can be collected and used again in the "water-cycle."

References

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