CHEMICAL BONDING OF NEW ALLOTROPES OF HYDROGEN AND ITS IMPLICATIONS TO FUEL SCIENCE

Andrew C. Angus
Absolute Foundation
2117 Wendover Lane, San Jose, CA 95121, U.S.A.
angusandrew@yahoo.com

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INTRODUCTION

The author predicts that polyatomic allotropes of hydrogen such as triatomic deuterium (D*3) and quadratomic deuterium (D*4) are formed inside the core of the sun.

The theoretical existence of triatomic deuterium molecules and other polyatomic allotropes of hydrogen in general is necessary in order to account nuclear fusion in the sun.

The theoretical existence of triatomic deuterium molecules and polyatomic allotropes of hydrogen if confirmed experimentally is important in fuel science since polyatomic allotropes of hydrogen increase the probability of nuclear fusion by virtue of their close distance to one another.

This paper explains the chemical bonding of triatomic and quadratomic deuterium atoms which can be applied to polyatomic hydrogen atoms in general.

MODELS OF CHEMICAL BONDS

1. Lewis Model of Chemical Bond

G. N. Lewis, an American physical chemist was the first to suggest that a **chemical bond** is composed of an "**electron pair**". (Masterton, p. 267)

The **Lewis model of chemical bond** in molecules or between atoms shows an electronic structure of a molecule or ion in which electrons are shown by dots or dashes (electron pairs). The Lewis model of chemical bonds does not show the actual physical models of the atoms. For example, the Lewis model of a diatomic hydrogen is illustrated as: H : H *or* H-H.

The Lewis model of chemical bond does not explain the possible existence of triatomic molecule of hydrogen or polyatomic allotropes of hydrogen in general.

2. Angus Model of Chemical Bond

The author proposes a chemical bond called "**single electron sharing**" between two atoms to explain the theoretical existence of a triatomic deuterium molecule, quadratomic deuterium molecule and higher polyatomic hydrogen molecules. This bond that is based on a "single electron sharing" is called "**mono-electron bond**" or "**alpha bond**". Hydrogen bonds between water molecule is a good example of an alpha bond or mono-electron bond.

Chemists failed to realize that the hydrogen bonding in water molecules and protein molecules could probably involve a "single electron sharing" bond.

The author coins the term "**di-electron bond**" as a synonymous term to Lewis' chemical bond of "**pair electron sharing**". The sigma bond is a good example of a "di-electron bond".

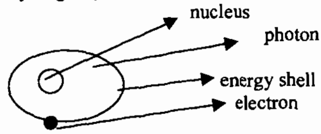
The "**quadri-electron bond**" is a "four-electron sharing" bond such as the chemical bond in an Oxygen diatomic molecule. The "quadri-electron bond" is synonymous to the "double bond".

The "**hexa-electron bond**" is a "six-electron sharing" bond such as the chemical bond in a Nitrogen diatomic molecule. The "hexa-electron bond" is synonymous to the "triple bond".

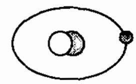
ILLUSTRATIONS

The author gives the illustrations of the allotropes of Hydrogen namely, **monatomic** hydrogen, **diatomic** hydrogen, **triatomic** hydrogen and **quadratomic** hydrogen:

1. Monatomic Hydrogen (H)

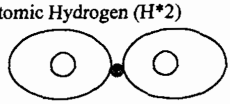


Monatomic Protium

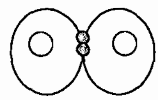


Monatomic Deuterium

2. Diatomic Hydrogen (H*2)



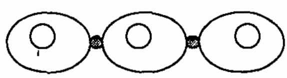
i).. **alpha bond**: single electron sharing



ii). **sigma bond**: pair electron sharing

3. Triatomic Hydrogen (H*3)

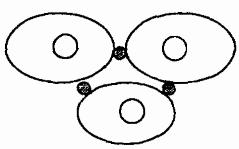
i). Chain structure of a triatomic protium molecule (H*3) and triatomic deuterium molecule (D*3).



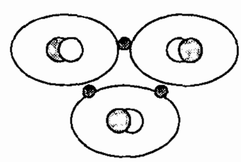
2 alpha bonds in H*3 ion

2 alpha bonds in D*3 ion

ii). Ring structure of a triatomic protium molecule (H*3) and triatomic deuterium molecule (D*3).



3 alpha bonds in H*3 molecule



3 alpha bonds in D*3 molecule

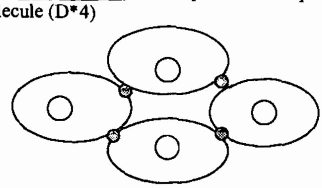
4. Quadratomic Hydrogen (H*4)

i). Chain structure of a quadratomic protium molecule (H*4) and quadratomic deuterium molecule (D*4)

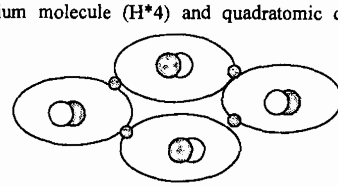
3 alpha bonds in H*4 ion →

← 3 alpha bonds in D*4 ion

ii). Ring structure of a quadratomic protium molecule (H*4) and quadratomic deuterium molecule (D*4)



4 alpha bonds in H*4 molecule



4 alpha bonds in D*4 molecule

DISCUSSION

A. Angus Model of an Atom

1. **Description.** The **Angus Model of the Atom** depicts atoms that looks like a "biological cell" with a central nucleus. The nucleus is surrounded by a quantum of energy or photon. The electron is at the surface of the photon. The **atom's energy realm** refers to the total area or volume occupied by the photon in an atom. The periphery of the photon is called the **atom's energy shell.** (See Illustration #1)

2. **Energy Barrier.** The electron cannot penetrate the nucleus because of the **photon energy barrier (hf).** The photon energy barrier (hf) is equal to the force (F) between the proton and the electron multiplied by the radius (r) distance between the nucleus and the electron.

$$F \times r = hf \qquad \text{eq.1}$$

3. **Photon Force.** The new model of the atom proposes that the force (F) between proton and electron is exerted through the medium of a photon energy (hf) that binds the electron and the nucleus at a certain distance (r). The force exerted by the proton on the electron through an photon energy medium is called a **photon force.**

$$hf / r = F \qquad \text{eq.2}$$

B. Angus Model of Chemical Bond

The Lewis Model of chemical bond of a **"pair electron sharing"** cannot account the new allotropes of Hydrogen namely the triatomic deuterium molecule (D*3) and the quadratomic deuterium molecule (D*4). The author's theory of chemical bond of **"single electron sharing"** called "alpha bond or mono-electron bond" can account the existence of new polyatomic allotropes of Hydrogen (such as D*3, D*4, D*5, etc.).

The concept of a "single electron sharing" of a diatomic hydrogen molecule was discussed theoretically in physics textbook . (Kenneth Krane, p. 360-364.) But the author did not use it to explain the possible existence of polyatomic allotropes of hydrogen molecules/ions. Furthermore, the author claimed that the attractive force of the electron **is greater** than the repulsive force exerted by the protons on the electron. (Krane p.360)

I believe: If the electron's attractive force is greater than the repulsive force of the two protons (as claimed by Krane p.360), then the two protons will fuse towards the electron. Therefore, physicist's analysis of a "single electron sharing" between two atoms would make a mono-electron bond an unstable bond.

Is a mono-electron bond (or alpha bond) stable or unstable? I offer an alternative analysis of a "single electron sharing bond". The two protons are both attracted to the single electron. The attractive force of this single electron shared by two protons **is equal** to the two protons' repulsive force exerted on the electron. The electron maintains its distance equally to the two protons. The electron stays in the middle of the two protons. The electron is not absorbed by the two protons. Thus, a mono-electron bond is stable.

$$\text{attractive force of electron on proton} = (1/4\pi\varepsilon)[e\text{^}2/(R)\text{^}2] \qquad \text{eq. 3}$$
$$\text{attractive force of electron on 2 protons} = 2(1/4\pi\varepsilon)[e\text{^}2/(R)\text{^}2] \qquad \text{eq.4}$$
$$\text{repulsive force of proton on electron} = (1/4\pi\varepsilon)[e\text{^}2/(R)\text{^}2] \qquad \text{eq.5}$$
$$\text{repulsive force of 2 protons on electron} = 2(1/4\pi\varepsilon)[e\text{^}2/(R)\text{^}2] \qquad \text{eq.6}$$
$$\text{attractive force of e- on two protons} = \text{repulsive force of two protons on e-} \qquad \text{eq.7}$$
$$2(1/4\pi\varepsilon)[e\text{^}2/(R)\text{^}2] = 2(1/4\pi\varepsilon)[e\text{^}2/(R)\text{^}2] \qquad \text{eq.8}$$

In Illustration #2, it can be gleaned that a diatomic hydrogen can either have an alpha bond (mono-electron bond) or a sigma bond (di-electron bond).

In the Illustration #3 (triatomic hydrogen) and #4 (quadratomic hydrogen), it can be gleaned that polyatomic allotropes of hydrogen in general can either have a chain structure or a ring structure.

In Illustration #3, triatomic deuterium has two alpha bonds since the K shell of deuterium can carry a maximum of two electrons. Instead of deuterium sharing the two electrons to one atom, deuterium is sharing one electron to each of the two atoms.

The nature of hydrogen bonding is a mystery to chemists. The author theorizes that hydrogen bonding occurs in water molecules when oxygen atom "share a single electron" to a neighboring hydrogen atom bonded to another oxygen atom.

C. Source of Polyatomic Hydrogen

I predict that triatomic deuterium (D*3) and quadratomic deuterium (D*4) and other polyatomic deuterium molecules exists in the sun. I believe that triatomic, quadratomic allotropes of hydrogen or polyatomic hydrogen atoms in general are the main fuel of the sun.

The sun has a high density 1.5 x 10^5 kg/m^3 about 13 times the density of lead, a high central pressure (approximately 2 x 10^11 atmosphere) and a central temperature of 1.5 x 10^7 Kelvin. (Halliday p. 1317)

The high pressure due to the gravitational pressure or the electromagnetic pressure in the sun could be the major factor in creating polyatomic hydrogen atoms such as triatomic deuterium (D*3), quadratomic deuterium (D*4), pentatomic deuterium (D*5), etc.

D + D + D + D + pressure + electricity→ D*4 eq. 9

If nuclear fusion reactions occur in the sun, then hydrogen atoms must be close to each other as in a "chain of polyatomic hydrogen atoms" or a "ring of polyatomic hydrogen atoms". Nuclear fusion reactions would be difficult to occur if hydrogen atoms exist as monatomic atoms. Thus, to facilitate nuclear fusion, polyatomic hydrogen must exist in the sun since polyatomic allotropes of hydrogen consists of hydrogen atoms that are very close to each other.

The high density of the sun is probably due to helium atoms and polyatomic allotropes of hydrogen. Monatomic hydrogen atoms tend to be far apart when heated to extreme high temperatures. An abundance of monoatomic hydrogen atoms will create a low-density sun. An abundance of polyatomic allotropes of hydrogen will help in creating high-density sun.

D. Energy Mechanism of the Sun

Hans Bethe made a theory explaining the energy mechanism of the sun based on thermonuclear model of nuclear fusion whereby heat initiated nuclear fusion.

However, I believe Bethe's Theory cannot be totally correct for the following arguments: 1). Extreme heat will encourage the formation of monatomic hydrogen ions rather than triatomic and polyatomic allotropes of hydrogen atoms. 2). Monatomic hydrogen ions are so far apart that the probability of nuclear fusion will be greatly decreased. 3). Pure monatomic hydrogen atoms will create a low-density sun. 4). Nuclear reactions can occur in proto-stars or actual stars even at low energy or low temperature (as will be explained in the next paragraph).

An alternative energy mechanism of the sun (without resorting to high temperature) involves high pressure to create polyatomic allotropes of hydrogen and electricity applied on these polyatomic allotropes of hydrogen as follows:

Phase 1

H + pressure + electricity → n-1 (K Capture of Hydrogen) eq.10
H + H + pressure + electricity→ H*2 eq.11
H*2 + pressure + electricity → n-1 + H → D + 2.22 MeV eq.12

Phase 2

D + pressure + electricity → n-2 (K Capture of Deuterium) eq.13
D + D + D + pressure + electricity → D*3 eq.14
D*2 + pressure + electricity → n-2 + D → **H-4** → T + n + 6.2 MeV eq.15
D*3 + pressure + electricity → n-2 + D*2 → He-6 → 2T + 12.4 MeV eq.16
D*3 + pressure + electricity → n-2 + D*2 → He-6 → He-3 + 3n + 4.15 MeV eq.17
D*3 + pressure + electricity → n-2 + D*2 → He-6 → He-4 + n-2 + 25 MeV eq.18

(Note: **Protium** is defined as a proton with an orbiting electron. **Hydrogen** is defined as an element with a single proton. Protium (H), Deuterium (D), Tritium (T), Quadrium (Q) are the four isotopes of Hydrogen. **Quadrium (H-4 or Q)** occurs in the reaction in equation 15.)

K Capture is a nuclear process that involves the absorption of orbital electron in the K Shell. K Capture is a key factor in overcoming repulsive energy barrier of atoms at low temperature with the help of electricity. The process of K Capture with the help of electricity converts Protium (H) into neutron (n-1) as shown in eq. 10. The process also converts Deuterium atom (D) into a di-neutron (n-2) as shown in eq. 13. (Angus 1999)

K Capture as induced by electricity is represented by the mathematical equation 19 called **Law of Electro-nuclear Effect** *(Angus 1999):*

$$\text{Net K.E. of electron} = qV - W \qquad \text{eq.19}$$

Meanwhile, the high pressure (Pb) in the sun will force the atoms to get closer to each other. Then, electrcity (qV) can increase the effective mass of orbital electron to produce neutrons or di-neutrons that will induce nuclear fusion of deuterium atoms. The repulsive energy barrier of the atoms can be overcome by the following equation whereby the orbital electron is subjected to the pressure (Pb) and the electricity (qV) in the sun:

$$\text{Net K.E. of electron} = (Pb + qV) - W \qquad \text{eq.20}$$

P is the pressure, b is the volume of the electron, q is the electronic charge, V is the voltage and W is the energy needed to overcome the repulsive energy of the atom.

Equation 20 is called the **Law of Piezo-electro-nuclear Effect** which explains K Capture as induced by pressure and electricity. This Law explains K Capture as a key factor in the energy mechanism of the sun or proto-suns at low energy or low temperature.

We can simulate the energy mechanism of the sun here on earth by creating polyatomic allotropes of hydrogen with the aid of electricity and pressure, then subjecting the polyatomic allotropes of hydrogen to further pressure and electricity to induce nuclear fusion or nuclear transmutations.

The extreme heat of the sun is most likely a by-product of the nuclear fusion reactions in the sun rather than heat as an initiating mechanism of nuclear fusion reaction.

CONCLUSION

The existence of triatomic deuterium molecule or polyatomic allotropes of hydrogen in general is significant to fuel science because these polyatomic allotropes of hydrogen increase the probability of nuclear fusion and therefore, a sustainable production of nuclear energy through nuclear fusion will be available to mankind.

We have to invent the concept of "alpha bond" or "mono-electon bond" to account the theoretical existence of polyatomic allotropes of hydrogen and in order to account nuclear fusion reactions in the high-density sun. Nuclear fusion in the sun is not possible if only monoatomic atoms exist in the sun since monoatomic atoms are very far apart. There has to be polyatomic allotropes of hydrogen in the sun since polyatomic allotropes of hydrogen (D*3, D*4, D*5, etc.) increase the probability of nuclear fusion by virtue of the close distance of hydrogen atoms in a polyatomic structure.

Perhaps, we have to say good-bye to Hans Bethe's theory of energy mechanism of the sun and replace it by the author's new energy mechanism of the sun.

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