On a Simple Superconductivity Model and New Superconducting Material

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Abstract: In this paper, we establish a simple superconductivity model based on virtual photons exchange mechnisim. It shows that this simple model can be used to explain the superconductivity mechanism for some superconductive materials by comparing the theoretical prediction with the experimental data. On this basis, we propose new possible structures that can produce high temperature superconductors.

0 Introduction

The first super conductor was found in 1911. More and more metals that have superconductivity were found afterwards. However, physicists also found that some metals never had superconductivity even it is in very lower temperature environments.

Alloys' critical temperatures are higher than pure metals. Higher critical temperature metal oxide ceramics were found in 1986[1]. After then, the MgB_2 [2,3] and iron-based superconducting materials[4,5] appeared. These new superconducting materials provide rich experiment data for the research of the superconductivity mechanism.

The relatively large impact superconductivity theory is the BCS theory at present [6]. The BCS theory can better explain the superconductivity phenomenon for metals.

Free electron gas model is the simple and effective model to solve the metal's conductive problem [7]. It points that the characteristics of electrons in metals are different from the electrons in bound states. Schrodinger's equation can be used to solve the bound state problems. It needs new theories to solve the free electron's problems [8].

A new theory of virtual photons can be used to solve the ground state energy problem of Helium [9]. This theory tell us how a virtual photon exchanging between two particles. We try to use the virtual photons exchanging mechanism to construct a simple superconductivity model, so that we can explain the super conductivity mechanism based on a more precise physical model. It can also provide simple theoretic basis for finding new superconducting materials.

1 Simple superconductivity model

1.1 The virtual photon exchanging method in particles interaction

The electron may be in "free particle" state, "bond particle" state or mixed state in metals or alloys. Schrodinger's equation can be used to solve the bound state problems. The free particles' problems can be solved by virtual photons equation [8].

If there is electro-magnetic interaction between two particles, it will cause one particle emits virtual photon to another particle. The possibility of emitting or absorbing a virtual photon is the fine structure constant α. It will cause the energy lost for the reason of possibility not equaling to 1.

Since the possibility of exchanging virtual is a constant, it also means that there are also

chances for not exchanging virtual photons in the particles interaction process. The condition of not exchanging virtual photons is that none particles can absorb virtual photon. For example, when a particle is in bound state, its energy is quantization. When this particle absorbs a virtual photon emitting from another particle, it will jump from one energy level to another energy level. However, if the virtual photon's energy is smaller than the difference between two neighbor energy levels of one bound particle, this particle is unable to absorb the virtual photon. So the other particle will also not emit virtual photon in this condition.

The particles that interacted with each other can be electrons, or the atoms, ions, molecules that constructing the crystal structure. So the virtual photon exchanging process can be happened between electron and electron, electron and atom, electron and ion or molecule.

1.2 Bound state and electron correlation length

The electrons in metal are more like free electrons. The free electron gas model had been successfully used to solve the problems of metal's conductivities. Why we can use free electron gas model to analyze the metal's conductivity problems, it is because that the bonding potential of the crystal lattice is very shallow. So we can use Fermi-Dirac's statistical distribution function to analyze the energy distribution of electrons in metal, and then calculate the metal's Fermi energy.

The crystal bond in non metal materials is covalent bond. Since the covalent bond is very strong, there are only a few free electrons in non metal materials. It is equal to that the potential that bonding the electrons is very deep. The out-ring electrons of the atoms in non metal material will not obey the constraint of Fermi-Dirac's statistics. All of the out-ring electrons can be in the same energy level state.

To represent the difference between metals and non metals, here we introduce the concept of electron correlation length (ξ). Electron correlation length reflects the relationship between two electrons' wave functions. If the electron correlation length is longer, it means that two electrons must obey the Pauli Exclusion Principle. The two electrons will not be in the same state. If there are many electrons that have strongest correlation in a system, then all electrons will obey Fermi-Dirac's statistical distribution. Why we do not use the concept of coherence here is because we cannot make sure the concept of correlation described in this paper is the same as the concept of coherence in old superconductivity theory.

For good metal, the correlation lengths among all the electrons are infinite, since we can use free electron gas model to describe it. So the highest energy is the Fermi's energy for good metals in 0K. For good non metal, the correlation lengths among all the electrons are nearly zero, since all the electrons are bounded in the covalent bond. Therefore, the highest energy is the highest energy of a single electron in 0K. The actual materials' correlation lengths are in between.

1.3 Crystal lattice oscillations

We had obtained many meaningful results from the harmonic oscillation model in solid physics. Here we still use the harmonic oscillation model to solve the super conductivity problems.

Crystal lattice is consisted with atoms or ions. The elastic coefficient of crystal bond is k. So the energy levels of the crystal lattice can be calculated:

$$E_k = n\hbar\sqrt{\frac{k}{M}} \quad \cdots\cdots (1)$$

Where, the M is the mass of one atom or ion.

We can see that all of the atoms or ions in crystal are in bound state by comparing with the

free electrons in metal. It means that the atoms or ions' oscillation energies are discontinuous. It can cause the energy jumping from absorbing virtual photons. However, if the virtual photon's energy is smaller than the difference between the adjacent energy level, the crystal lattice will not absorb any virtual photons.

1.4 The simple model of superconductivity

There are more or less conductive electrons in a material. Those electrons can be in between free or bound state. For different materials, the electrons' correlation lengths are also different. For good metals, the electrons in the metal obey Fermi-Dirac distribution. For good non-metals, all the electrons are in bound state, the electrons correlation lengths are zero.

The highest energy in good metal is the Fermi energy in 0K. That is $E_c=E_{F.}$ The highest energy in good non-metal materials is equal to the maximum energy of a single electron. So the highest energy in non-metal is smaller than other materials. That is $E_c=E_{min}$

If an electron jumps from the highest to the lowest energy, it will emit virtual photons. The condition of a particle emitting virtual photons is that there are other particles can absorb these virtual photons according to previous suppose. Or those virtual photons will change into real photons, and emit out of the metal. If the emitting virtual photons can be absorbed by crystal lattice, then the emitting and absorbing process is successful. The crystal lattice will get the energy ΔE_k . However, there is not equal to 1's probability to emit and absorb virtual photons. So there will be energy lost in this process. It may be the reason of why metals have resistance. On the contrary, there will not have the energy lost if the emitting and absorbing process not happening.

Therefore, the condition of there is superconductivity in a material is the energy emitted by the electrons must be smaller than the lattice oscillation energy difference. That is:

$$E_c < E_{kn} - E_{kn-1} = \hbar\sqrt{\frac{k}{M}} \quad \cdots\cdots (2)$$

2 The electron correlation length in different materials

The electrons correlation lengths are decided by the lattice potential depth of different materials. If the potential depth is deeper, the area that electrons are bounded will be smaller. So the electrons correlation lengths will be shorter.

It is difficult to get a material's correlation length directly. Here we use a simple method to calculate the electron correlation length. This method is directly using the material electric conductivity in room temperature to get this material's electron correlation length. The reason why we can do this is based on the assumption that if the electric conductivity is larger, then there are more free electrons in this material. If there are more free electrons, then the material's electron correlation length will be longer. Therefore, we can assume that the electric conductivity σ is proportional to the correlation length ξ.

$$\xi = a\sigma \quad \cdots\cdots (3)$$

Here, a is a constant.

Since the electron correlation length is shorter, the Fermi's energy calculation formula will be changed.

The Fermi energy's calculation formula is:

$$E_F \approx \frac{5\hbar^2}{m}\rho^{\frac{2}{3}} \quad \cdots\cdots (4)$$

Here ρ is the electrons density, m is the electron mass.

For those elements that have shorter correlation length, we can assume the correlation length is ξ , while the length of this material is L. So the equivalent electron density in this material is $K = \frac{\xi^3 V}{L^3 V} = (\frac{\xi}{L})^3$ times the good metal.

So by considering formula (3), we can get the highest electron ground energy of this material in 0K is:

$$E_c \approx \frac{5\hbar^2 K^2}{m}\rho^{\frac{2}{3}} = \frac{5\hbar^2 c^2 \sigma^2}{m}\rho^{\frac{2}{3}} = c^2\sigma^2 E_F \cdots\cdots (5)$$

Here, c is a constant; E_F is the Fermi's energy of this material.

In 0K, the electrons in this material are in ground state. The highest energy of electrons is E_c. If we improve the temperature or electric current intensity, the electrons' energy will increase. In super conduction state, the increasing energy should not exceed the minimum energy needed to cause the lattice oscillation. Or it will emit virtual photons to the crystal lattice, and cause the energy lost. So the maximum energy that an electron can get in the superconductivity critical state is the energy between two adjacent energy level of the lattice. That is:

$$\Delta E_c = E_k - E_c = \hbar\sqrt{\frac{k}{M}} - c^2\sigma^2 E_F \cdots\cdots (6)$$

Since $\Delta E_c = k_B T_c$

We can calculate the critical temperature:

$$\Delta E_c = k_B T_c = \hbar\sqrt{\frac{k}{M}} - c^2\sigma^2 E_F \cdots\cdots (7)$$

$$T_c\sqrt{M} = \frac{\hbar\sqrt{k} - b\sigma^2\sqrt{M}E_F}{k_B} = \frac{\hbar\sqrt{k} - bPE_F}{k_B} \cdots\cdots (8)$$

Here: $P = \sigma^2\sqrt{M}$, $b = c^2$

To get the superconductivity, it demands that the results calculated from formula (7) and (8) must be positive. If the results are negative, it means that this material do not have the superconductivity properties. Considering the constant b and E_F are always positive, we can use one constant a to replace them. Then we can get the superconductivity condition as:

$$P < \alpha \cdots\cdots (9)$$

Here: $\alpha = \frac{\hbar\sqrt{k}}{bE_F}$

The constant α has a relationship with the lattice structure. It reflects the elastic coefficient. We can see from formula (7), if the parameter P is larger, the superconductivity critical temperature will be lower, or vice verse. If the atom or ion's mass M in the lattice is bigger, the critical temperature will be lower too, or vice verse.

Table 1 shows the parameters comparison among some super conduction elements.

Tab.1 The parameters comparison among super conduction elements

Elements	T_C (K)	Electric conductivity σ(× $10^8 Sm^{-1}$)	Atomic weight	P	$T_c\sqrt{M}$

Al	1.175	0.377	26.982	0.738277732	6.103443598
Cd	0.517	0.0774	112.411	0.063516466	5.481443585
Ga	1.083	0.0678	69.723	0.038383752	9.043082425
Hf	0.128	0.0312	178.49	0.013005173	1.710081916
Hg	4.15	0.0104	200.7	0.001532288	58.79248039
In	3.4	0.116	114.818	0.144185294	36.43207488
Ir	0.1125	0.197	192.217	0.538057079	1.559726388
La	4.88	0.0126	138.90547	0.001871116	57.5147844
Mo	0.915	0.187	95.96	0.34255344	8.963264528
Nb	9.26	0.0693	92.90638	0.046290219	89.25524696
Os	0.65	0.109	190.23	0.163867376	8.965052984
Pa	1.4	0.0529	231.03588	0.042535453	21.27981026
Pb	7.19	0.0481	207.2	0.033303128	103.4960478
Re	2.4	0.0542	186.207	0.040086356	32.74984458
Ru	0.49	0.137	101.07	0.18869147	4.926145248
Sn	3.72	0.0917	118.71	0.09161832	40.53093219
Ta	4.48	0.0761	180.94788	0.077901544	60.26355724
Tc	7.46	0.067	99	0.044664986	74.22606281
Th	1.37	0.0653	232.03806	0.064954011	20.86892989
Ti	0.39	0.0234	47.867	0.003788348	2.698253268
Tl	2.39	0.0617	204.3833	0.054424323	34.1680823
U	0.68	0.038	238.02891	0.0222783	10.49116619
V	5.03	0.0489	50.9415	0.017066858	35.90077711
W	0.015	0.189	183.84	0.484332502	0.203381415
Zn	0.855	0.166	65.38	0.222812029	6.913350454
Zr	0.61	0.0236	91.224	0.005319595	5.826186609
Am	0.6	0.022	243	0.007544813	9.353074361
Be	0.023	0.313	9.012182	0.294105842	0.069046682
Cr	3	0.0774	51.9961	0.043198365	21.63249639
Li	0.0004	0.108	6.941	0.030729715	0.001053831
Pt	0.0019	0.0966	195.084	0.130336207	0.02653777
Rh	0.00032	0.211	102.9055	0.451631478	0.003246155

Comments: the data retrieved from http://superconductors.org/type1.htm and http://wiki.org

We can calculate that the correlation coefficient between P value and $T_c\sqrt{M}$ from table 1 is −0.383353263. It is significant in a=0.05. It means that there is significant relationship between theoretic value and experiment value. However, the calculation had not considered the impact of crystal lattice structure. On the other hand, we do not sure whether it is suitable to use the electric conductivity to replace the electron correlation length. Of cause, it also will cause larger errors by using the electric conductivity in room temperature to predict the electrons performance in lower temperature.

Since we can also calculate the elements' Fermi energy through the chemical potential, we can improve the table 1's results. After considering all of the elements' Fermi energy, we can re-calculate the electron correlation length in table 2.

Tab.2 The parameters comparison after considering Fermi's energy

Elements	TC (K)	Electric conductivity σ($\times 10^8 Sm^{-1}$)	Atomic weight	Fermi energy*	P	$T_c\sqrt{M}$
Hg	4.15	0.0104	200.7	6	0.0091937272	58.7924803865
La	4.88	0.0126	138.90547	6	0.0112266973	57.5147844016
Ti	0.39	0.0234	47.867	9.9	0.0375046411	2.6982532683
Zr	0.61	0.0236	91.224	8.2	0.0436206782	5.8261866088
Am	0.6	0.022	243	6.3	0.0475323239	9.3530743609
Hf	0.128	0.0312	178.49	8.4	0.109243453	1.7100819162
Li	0.0004	0.108	6.941	5.4	0.1659404613	0.0010538311
U	0.68	0.038	238.02891	8.8	0.1960490397	10.491166188
V	5.03	0.0489	50.9415	11.6	0.1979755563	35.9007771135
Ga	1.083	0.0678	69.723	5.8	0.2226257595	9.0430824251
Pb	7.19	0.0481	207.2	6.9	0.2297915841	103.4960478472
Tl	2.39	0.0617	204.3833	4.5	0.2449094513	34.1680822981
Nb	9.26	0.0693	92.90638	6.2	0.2869993598	89.2552469589
Tc	7.46	0.067	99	7	0.3126549024	74.2260628082
Pa	1.4	0.0529	231.03588	7.9	0.3360300766	21.2798102623
Cr	3	0.0774	51.9961	8.05	0.3477468357	21.6324963885
Th	1.37	0.0653	232.03806	6.52	0.4235001526	20.8689298914
Re	2.4	0.0542	186.207	11.19	0.4485663191	32.7498445798
Cd	0.517	0.0774	112.411	8.7	0.5525932551	5.4814435853
Sn	3.72	0.0917	118.71	7.5	0.6871373999	40.5309321877
In	3.4	0.116	114.818	4.8	0.6920894112	36.4320748792
Ta	4.48	0.0761	180.94788	9.7	0.7556449729	60.2635572361
Pt	0.0019	0.0966	195.084	6.92	0.9019265536	0.0265377701
Ru	0.49	0.137	101.07	7.4	1.3963168758	4.9261452476
Os	0.65	0.109	190.23	11.56	1.8943068683	8.9650529837
Mo	0.915	0.187	95.96	6.8	2.3293633896	8.9632645281
Zn	0.855	0.166	65.38	10.9	2.4286511201	6.913350454
Rh	0.00032	0.211	102.9055	7.4	3.342072939	0.0032461551
Al	1.175	0.377	26.982	6.5	4.798805258	6.1034435977
Be	0.023	0.313	9.012182	16.4	4.8233358164	0.0690466819
W	0.015	0.189	183.84	10.66	5.16298447	0.2033814151
Ir	0.1125	0.197	192.217	11.47	6.1715146976	1.5597263883

* Fermi energy's data is retrieved from：Huang R, Ma P P. (1995)[13]

The correlation coefficient between P value and $T_c\sqrt{M}$ from table 2 is -0.4061354528，it is significant in a=0.05. So we can find that the correlation coefficient is improved in the same confidence level.

If we only consider the twenty elements below Pb, the correlation coefficient is -0.5712430301, where the degree of freedom is 20, it is significant in a=0.01. Why the results can be improved significantly, it may be due to the system errors of P value. If P value is small, the system errors will cover the correlation between P value and $T_c\sqrt{M}$.

Table 3 shows the P value of three good conductive metals for comparing. We can find these elements don't have the superconductivity abilities even in 0K since their P value is so larger.

Tab.3 The P values of good conductive metal

Symbols	Elements	Electric conductivity ($\times 10^8 Sm^{-1}$)	Fermi energy*	Atomic weight	P

Ag	银	0.63	4.8	107.8682	14.54106062
Cu	铜	0.596	8.2	63.546	16.4442721
Au	金	0.452	6.4	196.966569	10.80800143

* Fermi energy's data is retrieved from: Huang R, Ma P P. (1995)[13]

3 The critical temperature of compounds

Although the superconductivity parameter P is so larger for some metals that there are no superconductivity phenomenon happened in those metals. However if we can use those metals and some other non metals to consist of the compounds, it will decrease the P value of those metals, and increase the conductive electrons density in those non metals. Since we can control the conductive electrons in these compounds, we can also control the superconductivity critical temperature of these compounds more effectively. Since the non metal's atoms are lighter than metal atoms, we shall paid more attentions to control the conductive electrons in non metals.

For example, the compound MgB_2, experiments show that the isotopic effect is happened in B ions. We can make sure the superconductivity of MgB_2 is due to the B ions. [3].

Since B element's electric conductivity is very small, there are few electrons in pure B crystal. So even the temperature is very low, there is no superconductivity in B element.

However, as B and Mg consists the compound MgB_2, a few of conductive electrons will release from B and Mg ions. By control the proportion of B and Mg ions, we can control the conductive electrons in compound MgB_2 more effectively. It will improve the superconductivity critical temperature significantly.

We can compare the MgB_2's data to the critical temperature of Nb in table 4. The P value in table 4 does not consider the impact of Fermi energy. It is the same with the following tables.

Tab.4 The comparison of MgB_2 data

Elements	T_C (K)	Electric conductivity $\sigma(\times 10^8 Sm^{-1})$	Atomic weight	P	$T_c\sqrt{M}$
Nb	9.26	0.0693	92.90638	0.046290219	89.25524696
B	-	1.00E-012	10.811	3.4367E-032	-
MgB_2	40	0.00413	10.811(B)	1.44E-006	131.52

Data retrieved from Buzea C, Yamashita T.（2011）[3]

From table 4 we can see that if we consider the electric conductivity of MgB_2 and the B's atom weight, the P value will be very small. Then table 4 shows the critical temperature of MgB_2 is also very high.

We can do the same calculation for cooper oxide compounds. The results are shown in table 5.

Tab.5 The comparison of $YBa_2Cu_3O_7$ data

Elements	T_C (K)	Electric conductivity $\sigma(\times 10^8 Sm^{-1})$	Atomic weight	P	$T_c\sqrt{M}$
Cu	-	0.596	63.546	2.0053990361	-
$YBa_2Cu_3O_7$	92	2.25E-5	15.9994(0)	1.614E-012	368

Data retrieved from：M. K. Wu, et al. (1987)[12]

For Fe and As compounds, the results are shown in table 6.

Tab.6 Comparison **of** $SmO_{0.9}F_{0.1}FeAs$ data

Elements	T_C (K)	Electric conductivity $\sigma(\times 10^8 Sm^{-1})$	Atomic weight	P	$T_c\sqrt{M}$
Fe	-	0.0993	55.845	0.0158012027	-
As	-	0.0345	74.9216	0.0010918285	-
$SmO_{0.9}F_{0.1}FeAs$	55	0.000625	74.92(As)	2.47163E-008	476.065

Data retrieved from：Chen N, Liu X, Jia Y K, et al. (2009)[11]

Some research showed that distance of rare earth element's ions and As ions is inversely proportional to the critical temperature [11]. The distance of ions reflects the elastic coefficient. If the distance is small, it means the crystal lattice's elastic coefficient is larger. It seems that the critical temperature of iron-based superconductors is decided by the As ions and the elastic coefficient of As's ionic bond. The goal of change the rare earth elements in iron-based superconductors are to change the elastic coefficient k of the crystal bond.

4 Prospect of new superconductive materials

4.1 Several standards for selecting new superconductive materials

There are four parameters that can have impact on new material's conductivity based on the simple superconductivity model established by this work. The four parameters are: conductive electrons density（ρ）, electron correlation length（ξ）, lattice atom or ion's mass（M）, lattice bond elastic coefficient（k）.

Three standards should be considered when selecting new superconductive materials.

1. The elements weight should be small

We can see from formula (7), the smaller the elements weight is, the higher critical temperature it will reach. Therefore, the suitable superconductive material should include the light elements, such as hydrogen, carbon and etc..

2. The distance between two adjacent lattice atoms or ions should be shorter

The short distance between two neighbor lattice atoms will increase the lattice bond elastic coefficient k. Large k can increase the critical temperature.

3. Control the free electrons density

If there are so many free electrons, it will increase the electron correlation length. So the electron's maximum energy will be higher for the demanding of Fermi-Dirac's distribution. It is the reason why some materials cannot have superconductivity even in 0K. We can control the electrons density by using different elements to consist of suitable compounds.

4.2 How to select high temperature superconductive materials

According to the three standards, we can consider to select the high temperature superconductive materials from these elements below.

H, B, C, N, O, F, Si, P, S, Cl, Ge, As, Se, Br

Of course, those elements are non metals. So there are few conductive electrons in those

materials. To make it be the semiconductor, we can combine them with the metals, such as Cu or Fe, to form the suitable compounds. For example, the cooper oxide compounds and FeAs compounds had been found have high critical temperature.

Since hydrogen is the lightest element, the even higher critical temperature superconductive material may be found in hydrides. For example, the oxygen's element weight is 16 times to hydrogen. We can do these estimates, if we can use hydrogen to replace oxygen in compound $YBa_2Cu_3O_7$, then the critical temperature will be $\sqrt{16} = 4$ times in the same condition. It means the critical temperature of this new material that includes hydrogen atom will reach to more than 360K. However, the crystal bond formed by Cu and H is unstable. It might have negative impact on this material's superconductivity.

Other suitable superconductive materials may be the organic molecule materials. Since there are many hydrogen atoms in those organic materials, they have large potential to be the future room temperature superconductive materials. The reason why current organic materials' critical temperature is not so higher is due to the carbon-hydrogen bonds can provide few conductive electrons. If we can replace the carbon atoms with the metal atoms, and use rare earth metals to solid the hydride molecules, the critical temperature of organic molecule materials will be improved effectively.

5 Possible structure of new super conductor

In summary, in order to obtain higher critical temperature, the structure of new super conductor may be $AD_xE_yG_z$

A are the rare earth elements. D are the dopant atoms. E are the atoms that can combine with G to form the compounds, such as Ge, Si, Se and other possible metals. G elements are the lighter elements, such as H, B, C, N, O, F, Si, P, S, Cl, Ge, As, Se, Br and etc. The E_yG_z compounds that had been confirmed to have superconductivity currently are cooper oxides compounds and iron arsenic compounds. The subscripts x, y, z are the ratio of different atoms in the superconductive compounds.

The goal of E combining with G to form the compound is to control the conductive electrons. A and D are the elements that can fix the G atoms and make it to be more stable. It will improve the elastic coefficient of the crystal bonds formed by A, D and G. The doping of A and D can also control the conductive electrons in the same time.

Therefore, the E and G elements may be the essential ingredients of a superconductive compound in the structure of $AD_xE_yG_z$. Here we call E_yG_z as the "superconductivity root". The superconductivity roots of known high-temperature superconducting materials are Cu_yO_z, Fe_yAs_z and Mg_yB_z. We believe that there are many other superconductivity roots. Some of them can satisfy the high temperature superconducting demands.

For example, if we replace the G element with hydrogen H, then we can get the structure below.

$AD_xE_yH_z$

H is the hydrogen atom. Hydrogen atom is the main atom that absorbs the virtual photons emitted by electrons.

If we use germane, then the structure will be:

$AD_xGe_yH_z$

Ge is the germanium atom.

Then we can consider some popular elements that used in cooper oxides or iron arsenic

compounds, and use those elements to replace A and D in the structure. We can get a variety of new high-temperature superconducting materials. For example, the $LaBa_xGe_yH_z$、$SmO_xGe_yH_z$ and etc.

On the other hand, there are some stable hydride compounds can also be applied, such as MgH_2, CaH_2 and etc. Therefore they can also be the suitable superconductivity roots. Some rare earth metal hydride compounds can also be considered as the future high-temperature material for their stability, such as $LaNi_5H_6$ and etc.

For some polymer material, the polymer molecules have not enough rigidity. It may cause the entire molecule structure absorb the virtual photons. Since the mass of polymer molecule is so larger, it may have negative impacts on those materials. We can consider to doping the metal atoms or rare earth elements into the polymer molecules. We can use the metal atoms to replace the carbon atoms, and use the rare earth atoms to solid the hydrogen atoms. It may improve the critical temperature of these polymer materials.

For example, if we can use some other elements to solid the polypropylene molecules, and firm the stability crystal structure, and doping some elements to combine with hydrogen atoms to firm suitable superconductivity root, we believe the polypropylene may be the very potential higher temperature material.

Table 7 shows some possible superconductivity roots. We also calculate the possible critical temperature of different superconductivity roots by comparing with the critical temperature of cooper oxides compounds.

Tab.7 Different superconductivity roots and their critical temperature

Super conductivity root	G's atomic weight	Critical temperature (K)
Cu_yO_z	15.9994	130*
Fe_yAs_z	74.9216	60
Mg_yB_z	10.811	158
E_yH_z	1.00794	518
E_yC_z	12.0107	150
E_yN_z	14.0067	139
E_yF_z	18.998	119
E_yP_z	30.974	93
E_yS_z	32.065	92
E_yCl_z	35.453	87
E_yBr_z	79.904	58

*Copper oxide compounds' critical temperature is the experiment value

Since the data in table 7 is based on cooper oxides compounds, if future experiments show that the cooper oxides compounds have even higher critical temperature, then the other superconductivity roots will also have even higher critical temperature.

6 Conclusion

In this paper, we establish a simple superconductivity model, so we can analyze the mechanism of superconductivity in some extents. By the comparing of theoretic prediction and

experiment data, we find that this model can describe the superconductivity to a certain extent. The errors rose from the uncertainty understanding of the mechanism of electrons correlation length. We need to establish a more detailed model to describe electrons correlation length.

Since the model is very simple, we can analyze the mechanism of high temperature superconductivity in a simple way. We predict that the structure of future high temperature superconductive material will be $AD_xE_yG_z$. Where A, D, E, G are the replaceable elements. We also give some examples of high temperature superconductors. Of course, it will need the experiments to test these materials.

From our points of view, since the electrons correlation length is so longer, good metal do not have the superconductivity capability. However, there are few conductive electrons in good non metals, so they also cannot have the superconductivity capability. It means the superconductive materials must be the not good metals or not good insulators. It shows to us that the superconductivity may origin from the defects of a material. The defects of a material can destroy the perfect Fermi-Dirac distribution.

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