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MECHANISM OF TRIBOELECTRIC EFFECT

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Electric charge, triboelectricity, triboelectric effect, static electricity, gas laws, electric potential, electric energy, electron, electronic gas, electronic cloud.

The Summary

If physical bodies are or have recently been grounded, the chaotic motion speed of their electronic clouds electrons have to be equal. If to bring to contact two bodies – porters of electronic clouds with substantially different electronic gas pressure, and thereafter to pull then apart, the masses of the clouds will change, and as the content of the change there will be the transfer of a part of electrons from the cloud that had a higher pressure to that that had a lower one. Objects made from dielectrics have no clouds that would fully cover them up. Instead such objects have multitude of micro-clouds covering up separate molecules or groups of molecules, and are connected with each other only with ether. In order to achieve during triboelectric charging even more number of contacted micro-clouds associated with dielectric objects, one would need to rub them one against another. Charged dielectric objects longer and contrary to conductors conserve their charges, by which charges we mean either electrons surplus, or electrons lack.

Preface

As one can get to know from [1], the triboelectric effect is a type of contact electrification in which certain materials become electrically charged after they come into frictive contact with a different material. Rubbing glass with fur, or a comb through the hair, can build up triboelectricity. Most everyday static electricity is triboelectric. The polarity and strength of the charges produced differ according to the materials, surface roughness, temperature, strain, and other properties. The triboelectric effect is not very predictable, and only broad generalizations can be made. The most widely known examples of tribo-electrification is charging of amber by friction with wool, which was first recorded by Thales of Miletus who suggested the word “electricity” from the Greek word “electron” that means amber. Other broadly known examples are glass rubbed with silk, and hard rubber rubbed with fur.

In 1757 John Carl Wilcke published a paper describing triboelectric series in which different materials were listed in order of the polarity and charge intensity on separation after they were touched with another object. A material towards the bottom of the series, when touched to a material near the top of the series, will acquire a more negative charge. The farther away two materials are from each other on the series, the greater the charge transferred. Materials near to each other on the series may not exchange any charge, or may even exchange the opposite of what is implied by the list.

Although the prefix “tribo” comes from a Greek word that means “friction”, for changing charges two interacting materials need only to contact each other. Explaining the mechanism of such changing, the source [1] asserts that after coming into contact, a chemical bond is formed between parts of the two surfaces, called “adhesion”, and charges move from one material to the other to equalize their electrochemical potential. This is what creates the net charge imbalance between the objects. When separated, some of the bonded atoms have a tendency to keep extra electrons, and some a tendency to give them away. Such explanation seems badly grounded, badly comprehensible, and inadequate to the views of the Ether friendly physics on physical nature of electric charges [2].

Therefore the aim of this disclosure is to provide such mechanism of triboelectric effect that would be fully conform to the concepts declared by the Ether friendly physics and disclosed in [3 and 4].

Triboelectric effect and gas laws

According to the above mentioned concepts physical bodies from electroconducting materials can be considered as containing protonic matter, with which are made atomic, molecular and ionic nuclei, and electrons, which electrons are partly placed on circum-nuclear orbits, and partly make up electronic gas that covers up physical body like a cloud, in which the electrons are in a continuous chaotic motion with equal speed for all the cloud. Electronic cloud is pressed to the protonic matter by the forces of Fatio that had came to science under the name of “electromagnetic” ones, and as the result each separate body has its own and usually unconnected with others electronic cloud. Although the physical bodies most broadly associated with triboelectric effect are not electrically conducting, and as we will see further are not associated with only one, but with more important number of electronic clouds, the proposed here below model of triboelectric mechanism is built on interaction of only two bodies, both having only one electronic cloud. Moreover, in order to simplify the model’s analysis we propose the two clouds to have equal masses.

If physical bodies are or have recently been grounded, the chaotic motion speed of their electronic clouds electrons have to be equal. Electronic clouds associated with two different bodies can have different masses and therefore – different special energies (integral motion energies of electrons contained in a unitary volume of the cloud) and different pressures of the electronic gas. The last, according to our convictions has all the signs of the ideal gas, and as well as the ordinary molecular gases has to obey the well known Law of ideal gas [5]

$$PV = nRT \quad (1), \text{ where}$$

P is the gas pressure,

V is the gas volume,

n is the amount of the gas matter in moles,

R is the universal gas constant equal to the product of constant of Boltzmann and the constant of Avogadro,

T is the gas temperature.

In our views the electronic gas satisfies all the requirements to the ideal gas, and therefore taking into account its particularities as well as the ideas expressed in [5], the formula (1) for electronic gas can be written as

$$PV = E \quad (2), \text{ where}$$

P is the electronic gas pressure,

V is the volume of the unity of the electronic gas mass,
 E is the kinetic energy of the unity of the electronic gas mass that occupies the said volume.

For two different electronic clouds the above equation allows to write

$$P_1 V_1 = P_2 V_2 = E \quad (3), \text{ or}$$

$$\frac{P_1}{P_2} = \frac{V_2}{V_1} \quad (4).$$

If for two taken for example clouds 1 and 2 of unitary mass, the volumes V_1 i V_2 are the volumes of unitary masses, they must be as well their actual volumes, and these actual clouds' volumes as well as the pressures P_1 i P_2 are as we can it see dependent only on the particularities of their porters.

If to bring to contact the porters of the clouds 1 and 2 and to allow the clouds 1 and 2 to unite in a common cloud 3, the unitary mass volume of the united cloud will make $V_3 = \frac{V_1+V_2}{2}$ (because the mass has doubled), and its pressure will make $P_3 = \frac{P_1 V_1 + P_2 V_2}{V_1 + V_2}$. If to take for example $P_1 = 10$, $V_1 = \frac{1}{10}$, $P_2 = 2$, $V_2 = \frac{1}{2}$, $E = 1$, we will obtain

$$P_3 = \frac{P_1 V_1 + P_2 V_2}{V_1 + V_2} = \frac{1+1}{6/10} = \frac{10}{3}. \quad V_3 = \frac{6}{10 \cdot 2} = \frac{3}{10}. \quad P_3 V_3 = 1.$$

For better clearness we put the data in the Table 1.

Table 1

| Pressure | Volume | | Mass | Energy |
|-----------------------------|------------------|--------|-----------|-------------------|
| | Of unity of mass | actual | | |
| $P_1 = 10$ | $V_1 = 0.1$ | 0.1 | $m_1 = 1$ | $P_1 V_1 = E = 1$ |
| $P_2 = 2$ | $V_2 = 0.5$ | 0.5 | $m_2 = 1$ | $P_2 V_2 = E = 1$ |
| $P_3 = \frac{10}{3} = 3.33$ | $V_3 = 0.3$ | 0.6 | $m_3 = 2$ | $P_3 V_3 = E = 1$ |

If to separate the cloud 3 porters again, the renewed clouds 1a and 2a will take the previous actual volumes V_1 i V_2 , the pressure of their electronic gas will retain the value P_3 , and the unitary masses of the both clouds 1a and 2a will retain збережуть the volumes V_3 . The relation $\frac{V_1}{V_3} = \frac{0.1}{0.3} = \frac{1}{3}$ will show how much the mass of the cloud 1a will decrease relatively to the cloud 1, as well as the relation $\frac{V_2}{V_3} = \frac{0.5}{0.3} = \frac{5}{3}$ will show how much will increase the mass of the cloud 2a relatively to the cloud 2. The masses of the clouds 1a and 2a will make in sum $\frac{1}{3} + \frac{5}{3} = 2$, just as it was expected.

The data for the renewed clouds 1a and 2a are put to the Table 2

Table 2

| Pressure | Volume | | Mass | Energy |
|-----------------|------------------|--------|------------------------|-------------------------|
| | Of unity of mass | actual | | |
| $P_{1a} = 3.33$ | $V_{1a} = 0.3$ | 0.1 | $m_{1a} = \frac{1}{3}$ | $P_{1a} V_{1a} = E = 1$ |

| | | | | |
|-----------------|----------------|-----|------------------------|------------------------|
| $P_{2a} = 3.33$ | $V_{2a} = 0.3$ | 0.5 | $m_{2a} = \frac{5}{3}$ | $P_{2a}V_{2a} = E = 1$ |
|-----------------|----------------|-----|------------------------|------------------------|

As one can understand from the above disclosed, the operation of clouds unification and further separation would result in the body's 1 losing two thirds of its electronic cloud's mass and becoming charged positively, and the body's 2 gaining two thirds of its electronic cloud's mass and becoming charged negatively.

The above disclosed shows that if to unify two bodies – porters of electronic clouds with substantially different electronic gas pressures, and then to separate them again, the clouds' masses will owe to change, and as the content of the change there will be the transfer of a part of electrons from the cloud that had a higher pressure to that that had a lower one.

The role of mutual friction of charged materials

Although, as it was declared in the Preface, to obtain the triboelectric effect it suffice simply to touch one body against another, in most of the cases such simple operation reveals as insufficient and for obtaining the wanted result one would need to rub them one against another, which explains the name of the effect. As it is known the most of materials used for demonstration of the effect are dielectrics, i.e. materials badly conducting electric current. Such bad electro conductivity can be explained by that contrary to the conductors, the objects made with dielectrics do not have such clouds that would them completely cover up. Instead these objects have multitudes of micro-clouds that cover up separate molecules or groups of molecules and are connected with each other only by ether. Therefore in order to bring to contact the most possible number of such micro-clouds associated with such or another object one needs to rub them one against another. Additionally the charged dielectric objects longer and contrary to the conductors retain their charges, by which charges we mean either electrons surplus, or electrons lack.

CONCLUSIONS

- 1) If physical bodies are or have recently been grounded, the chaotic motion speed of their electronic clouds electrons have to be equal;
- 2) If to bring to contact two bodies – porters of electronic clouds with substantially different electronic gas pressure, and thereafter to pull then apart, the masses of the clouds will change, and as the content of the change will be the transfer of a part of electrons from the cloud that had a higher pressure to that that had a lower one;
- 3) Objects made from dielectrics have no clouds that would fully cover them up. Instead such objects have multitude of micro-clouds covering up singles or groups of molecules, and are connected with each other only with ether;
- 4) In order to achieve during triboelectric charging even more number of contacted micro-clouds associated with dielectric objects, one would need to rub them one against another;
- 5) Charged dielectric objects longer and contrary to conductors conserve their charges, by which charges we mean either electrons surplus, or electrons lack.

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