Electromotive Force Generated in All Materials under Temperature Difference

(Short title : Thermoelectric effects of all materials)

Doi: https://doi.org/10.21203/rs.3.rs-1137728/v2

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Abstract

In this research, we investigate the thermoelectric effects of general materials. The results of this showed that an electromotive force was generated under a temperature difference between two points in materials. As no material has infinite electric resistance, an electromotive force is expected to be generated under a temperature difference in all materials. In conclusion, the thermoelectric effect generates an electromotive force.

This electromotive force causes an electric current to flow, thereby generating a magnetic field.

This magnetic field generates the Earth's magnetic field, triboelectricity, sunspots, and kinetic energy of celestial bodies.

This temperature differential electromotive force also generates lightning and creates an ionosphere that reflects radio waves.

Keywords: Thermoelectric effects, Temperature difference electromotive force, Friction electricity, Earth magnetism, sunspots

1. Introduction

The thermoelectric effect of two metals was discovered by T. J. Seebeck, a German physicist.[1]

This research shows the thermoelectric effect of non-metallic materials (e.g. soil etc) in which an electromotive force is generated under a temperature difference through the migration of electric charges. An electromotive force (voltage) was generated in all the materials used in the experiment under a temperature difference. As no material with infinite electric resistance exists, an electromotive force is expected to be generated under a temperature difference in all materials.

Under a temperature difference between two points of all materials, an electromotive force is generated because electric charges migrate.

This electromotive force causes an electric current to flow, thereby generating a magnetic field (Framing's left-hand rule).

Such a thermoelectric effect of material explains the induction of static electricity by friction, the generation of geomagnetic fields, the electromotive force of lightning, the release of electromotive force through spark discharge between clouds, the generation of sunspots and the relevant magnetic field, the reverse rotation of planets, the release of electromotive force through spark discharges in volcano eruptions, the release of electromotive force through spark discharge in large fires, the generation of electromotive force through spark discharge in nuclear explosions and the formation of the ionosphere that reflects electromagnetic waves.

2. Thermoelectric effect

Under a temperature difference between two points of all materials, an electromotive force (voltage) is generated as electric charges are migrated.

This electromotive force causes an electric current to flow and generate a magnetic field (Framing's left-hand rule).

In this research, a temperature difference was generated between two points of a material such as soil and the potential difference was measured.

Figure 1 shows the temperature difference and charge transfer state of materials.

The materials that are charged positively on the high-temperature side are defined as "positive temperature polarity materials" and those that are charged negatively on the high-temperature side are defined as "negative temperature polarity materials."

For example, water and iron, are positively charged on the high-temperature side and negatively charged on the low-temperature side.

Contrarily, the negative temperature polarity materials, such as soil and ice, are negatively charged on the high-temperature side and positively charged on the low-temperature side.

2.1 Negative temperature polarity experiment

When the temperature of the soil increased, as shown in Figure 2, the voltage was gradually increased from −46.9 mV > −57.5 mV > −70.6 mV > −85.9 mV > −93.5 mV > −110 mV > −126.3 mV.
This shows that an electromotive force is always generated if there is a temperature difference, even in non-metallic materials.
Figure 2 shows the voltage was measured by increasing the temperature of the soil by using an electric heater.
As a result of this experiment, negative temperature polarity materials were soil, ice and stainless steel (Table 1).

2.2 Positive temperature polarity experiment

Table 2 shows the results of the positive temperature polarity experiment
Positive temperature polarity materials were Water, Snow, Steam, etc. (Table 2).

3. The cause of triboelectricity is the temperature difference caused by friction heat

Figure 3 compares the current theory of triboelectricity with this research.
The current theory of triboelectricity (the triboelectric effect [2]) is static electricity caused by the movement of electrons owing to friction.[2]
According to the results of this research, it is argued that frictional electricity is the static electricity caused by electron migration owing to temperature difference, as the temperature of the portion subject to friction is increased by the heat generated owing to the friction.Therefore, it is necessary to revise school textbooks.

4. The cause of the strong magnetic field when sunspots occur

The temperature of the sunspot part of the sun is approximately 3000°C-4000°C, and the temperature around it is approximately 6000°C.[3]
The temperature difference between the sunspot and the surrounding area is "2000°C–3000°C**."**
Therefore, when a sunspot occurs, a large amount of current flows around the sunspot and a strong magnetic field is generated.

5. Evidence that a temperature difference creates an electromotive force

The following is evidence that a temperature difference creates an electromotive force.

1) When a sunspot occurs, a strong magnetic field is generated due to the temperature difference.
2) Lightning occurs when there is a large temperature difference in the atmosphere.
3) Static electricity of triboelectric generated by frictional heat.
4) Earth's magnetic field caused by global temperature difference.
5) Spark emission owing to temperature difference during volcanic eruption.
6) In case of a large fire, sparks are generated owing to the temperature difference.
7) In case of nuclear explosion, spark discharge owing to temperature difference.

6. Discussion

The results of this research show that an electromotive force was generated under a temperature difference between two points, even in non-metallic materials.

It is assumed that the kinetic energy of a celestial body also arises from the temperature difference.

When an electric current generated by a temperature difference in a celestial body flows through a celestial body, a magnetic field is created, and the force of this magnetic field rotates the celestial body [Fleming's left hand rule, Motor principle].

The celestial body rotates due to the force of the magnetic field, and as it rotates, it functions as a generator (Fleming's right hand rule), which continues to rotate as if the motor and generator are combined.

Therefore, the celestial body (Earth) generates electricity and charges the celestial body (Earth).

In other words, the Earth charges a lot of electrical energy with a generator rotating at high speed (equator: 1600 km/h). It is necessary to study how to utilize this charged electric energy.

The results of this research show that an electromotive force was generated under a temperature difference between two points, even in non-metallic materials (e.g. soil and water).

Since there is no material of which electric resistance is infinite, an electromotive force is expected to be generated in the presence of a temperature difference between two points in all materials.

Data availability

Data supporting the findings of this manuscript are available from the corresponding author upon reasonable request (songdi27@daum.net).

Code availability

All code for data cleaning and analysis associated with the current submission is available at https://doi.org/10.21203/rs.3.rs-1137728/v2

References

[1] Seebeck effect https://en.wikipedia.org/wiki/Thermoelectric_effect#Seebeck_effect (Accessed on 8 September 2021)

[2] Triboelectric effect https://en.wikipedia.org/wiki/Triboelectric_effect (Accessed on 27 October 2021).

[3] Sunspots https://www.schoolsobservatory.org/learn/astro/solsys/sun/sunspots (Accessed on 6 November 2021).

Declarations

Acknowledgement: I thank the reviewers for reviewing this paper. I would like to thank my wife, Yeongsuk Lee, who helped with the temperature difference experiment, and my daughter, Jihyeon Song, who reviewed the proofreading of the thesis. As a retired Meteorological Agency, I am submitting this thesis as an individual. Therefore, we have no interest in any institution or company. The expenses are planned to be spent with personal funds.

Author Contribution: The author (Dongil Song) confirms sole responsibility for the following: study conception and design, data collection, analysis and interpretation of results, and manuscript preparation.

Competing Interest: Author declares that there are no competing interests.

Table 1. Data of negative temperature polarity experiment

Materials	Temperature difference (Low T–High T)	Electromotive force (Voltage)
Soil (Figure 2)	22°C–34°C	−126.3mV
Soil–Ice	0°C–17°C	−600 mV
Soil–Stainless steel–Ice	0°C–17°C	−300 mV
Soil–stainless steel	10°C–17°C	−260 mV
Stainless steel–Ice–Stainless steel	0°C–23°C	−250 mV
Stone–Ice–Stainless steel	low T–high T	−221 mV
Ice	low T–high T	−73.2 mV
Stainless steel–Ice–stainless steel	0°C–50°C	−60 mV

Table 2. Data of positive temperature polarity experiment

Materials	Temperature difference (Low T–High T)	Electromotive force (Voltage)
Water	low T–high T	+850 mV
Water (Water from melted snow)	0°C–10°C	+978 mV
Snow	0°C–10°C	+864 mV
Soil–Iron	10°C–17°C	+420 mV
Stainless steel–Water	15°C–20°C	+280 mV
Stone–Steam–Stainless steel	low T–high T	+250 mV
Stainless steel–Ice–Iron plate	0°C–50°C	+60 mV
Steam	low T–high T	+35 mV

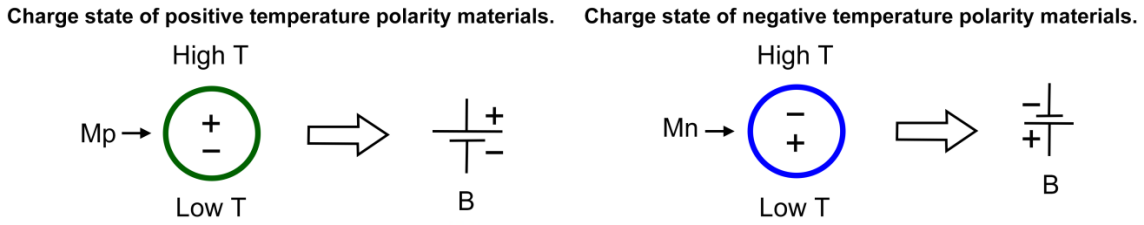

Figure 1. Temperature difference and charge states of materials.

Mp: Positive temperature polarity materials (Water, Iron, etc.),

Mn: Negative temperature polarity materials (Soil, Ice, etc.),

+: Positive charge, −: Negative charge, B: Battery.

Figure 2. Soil temperature difference experiment.

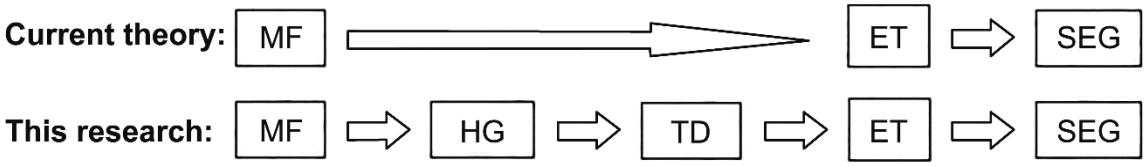

Figure 3. Comparison of current theory with this research.

MF: Material friction (Hair, etc.), HG: Heat generation, TD: Temperature difference,

ET: Electron transfer, SEG: Static electricity generation