

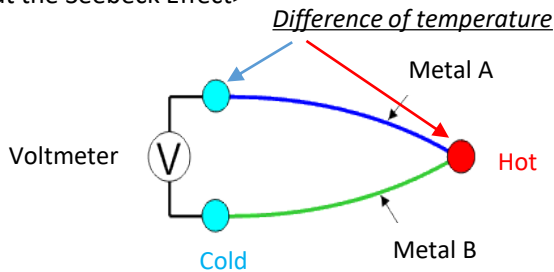
# Electricity Generation using an Alcohol Lamp with W and Ni

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## Introduction

We can generate electricity easily and in an ecofriendly way by using the 'Seebeck Effect.'

<About the Seebeck Effect>



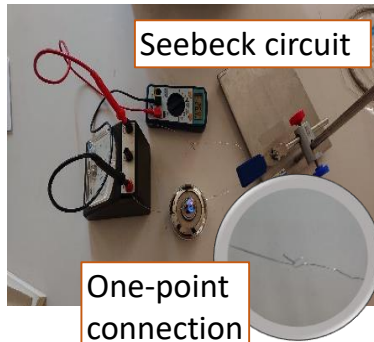
## GENERATE VOLTAGE

## Purpose

We made the 'Seebeck circuit' like the figure on the right. We used tungsten (W) and nickel(Ni) for two metal wires and an alcohol lamp as a heat generator. As a check, we measured the voltage generated from this Seebeck circuit every second. Then, we had two questions.

1. Why dose the voltage suddenly increase?
2. Why dose the direction of the voltage change suddenly?

In this study, we focused on finding out what was happening.



## Hypotheses

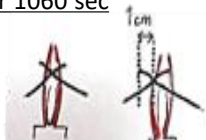
1. The Oxidation on the surface of the metal wires results in an increase of voltage magnitude.
2. The difference of the heating position on the metal wires due to the alcohol lamp changes the direction of the voltage.

## Methods

① We did experiments with these two procedures if needed.

**Procedure 1;** oxidize metal-wires in advance for 1060 sec

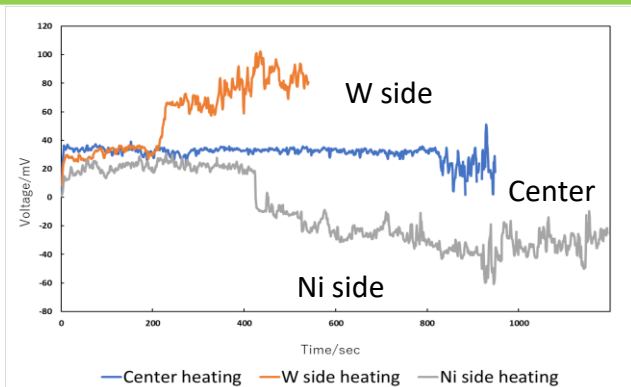
**Procedure 2;** Change the point of heating on metal-wires : Center-heating, one side-heating



② We read the voltage every second and made graphs to see how the voltage changed.

Center heating One side heating

## Result 1



(figure1) W-Ni

Relationship Between Voltage And Heating Position

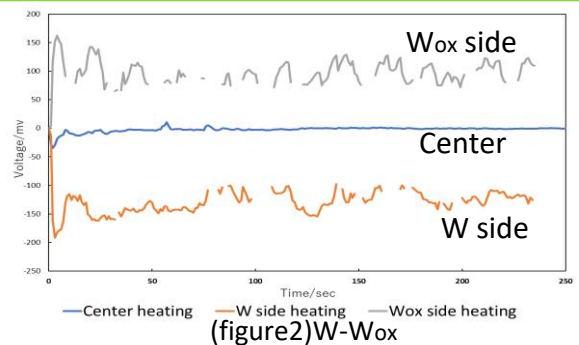
## Result 2

### Pre-oxidizing effect

State of Used Metal Wires	W and Ni	W <sub>ox</sub> and Ni	W and Ni <sub>ox</sub>	W <sub>ox</sub> and Ni <sub>ox</sub>
Voltage (mV)	17	134	24	31

Ox : oxidized in advance for 1060 seconds

## Result 3



Relationship Between Voltage And internal state of metal

## Consideration

**Result1** Center-heating → the connection point is **not oxidized**  
**one side-heating** → the connection point is **oxidized**

**Result2** Making **metals oxidized** → **increase** voltage

**Result3** Alcohol lamp oxidized → **only metals' surface**

The more the metals at the connection point that are oxidized, the more voltage we can get.

### Two new postulates

- 1; The electrons in the circuit are blocked by an oxide film.
- 2; The metals near the hot area around the oxide film try to become ions.

## Conclusion

● A sudden rise in the voltage and the change in the direction

→ influenced by the oxidation of the metal-wires' connecting points.

● One side heating

→ higher voltage was obtained

We couldn't determine the mechanisms for these.....  
To find the mechanism is our next task.

## Reference

国立天文台 (2018) 「理科年表」 丸善出版  
飯田修一ほか(1978) 「新版物理定数表」 朝倉書店