

Radio wave emission in friction or collision of various materials

TAKANO, Tadashi^{1*} ; HANAWA, Rikuya¹ ; SAEGUSA, Saegusa¹

¹Nihon University

1. Introduction

In fracture of rock, radio wave emission was found experimentally [1]. This phenomenon could be used to detect a rock fracture during an earthquake or a volcanic activity [2] [3]. The cause of the radio wave is expected to be micro-discharges, which are generated by an inhomogeneous potential distribution around micro-cracks [4]. However, the theory of emission is not completely understood yet.

In order to clarify the cause of radio wave emission, we carried out experiments to detect the emission in the cases of friction or collision of various materials. This paper describes the experimental results, and a brief explanation of physical process.

2. Tested systems and experimental results

We tested the following systems using the manufactured measuring system at 1 MHz, 300 MHz, 2.0 GHz, and 18.8 GHz [5].

(1) A lighter using piezoelectricity

This device makes sparkles by knocking a mineral with piezoelectricity. Due to discharges, strong radio wave is emitted, and detected in our measuring system.

(2) A lighter using friction of OL metal

Formerly, this type of a lighter was widely used for igniting cigarettes. The alloy metal of cerium and iron rubs a revolving drum so that sparkles are made changing the friction power to thermal energy. Despite significant sparkles, radio wave could not be detected in this case.

(3) Igniter using a flint stone

A flint stone is struck against iron pyrites so that small flakes of iron are scattered being made hot. The flint stone is mostly chert in Europe, and quartz, sanukite, or obsidian in Japan. Sparkles cannot be made by striking two bulks of flint each other. Radio wave is not emitted in this case.

(4) Striking a steel lump with a steel hammer

Radio wave is emitted in this case. Probably, the kinetic energy is converted not to thermal energy but to the excitation of electrons or atoms so that inhomogeneous potential distribution is realized.

3. Conclusions

In general, sparks are not the origin of radio wave emission. This emission is esteemed a non-thermal phenomenon. An inhomogeneous potential distribution makes micro-discharges that emit radio waves. In some cases, the cause of an inhomogeneous potential distribution makes the sparks.

Further study is needed to clarify the mechanism of the energy transfer to electron excitation.

References

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Keywords: radio wave, friction or collision, various materials, electrical discharge, micro-crack, non-thermal phenomenon