Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

SCG15-02 Room:203 Time:May 24 15:35-15:50

Exclusion of metal contact noise in the experiment of radio wave emission due to rock fracture

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1. Introduction

Formerly, the radio wave emission due to rock fracture was found at the frequency of 300 MHz to 22 GHz [1]. This phenomenon gathered much attention, as a possible tool to measure or even to predict a rock fracture in nature, which may be an earthquake or volcanic eruption [2] [3].

On the other hand, it was confirmed that radio waves were generated when metallic parts in the experiment system collided each other [4]. It is inferred to be caused by electric discharge due to charging effect of metallic parts by contact or collision [5]. Therefore, it is absolutely needed to discriminate these signals that were not originated by rock fracture itself.

Recently, we have remodeled the experiment system, of which all metallic pars are electrically shorted. Accordingly charging effect of the metallic parts is prevented in the rock fracture process. This paper describes the constitution of the experimental system and measured results.

2. Experimental system

The experimental system is composed of a destruction subsystem and a signal detection subsystem. The destruction system consists of a hydraulic pressing machine, a base plate, a ceiling plate, connecting poles, bolts and nuts. Theses all parts are connected with 24 twisted wires of 5 mm width and 1 mm thickness and with 9 twisted wires of 2 mm width and 0.5 mm thickness by screwing or soldering.

The signal detection subsystem is the same as the former one [4]. At each frequency of 1 MHz-, 300 MHz-, 2GHz-, and 18 GHz-bands, an antenna, a low noise amplifier and a filter are installed. The destruction and emission phenomenon is instantaneous so that a special recorder and a triggering system to activate a main memory are inevitable.

The rock specimens were quartzite, granite, gabbro, and basalt.

3. Measured results

We obtained the following results.

(1) In all rock cases, radio wave at 300 MHz was observed simultaneously with the destruction.

(2) Especially, in the case of quartzite, a weak 18GHz signal was observed in addition to a strong 300MHz. These signals occurred simultaneously.

(3) Cylinders of mortar were used as a specimen. But signal was not detected.

(4) When the rock debris, a laid blue sheet or a vinyl cover touched each other, radio waves were observed. The generated frequencies are strong 300MHz, weaker 2GHz, and the weakest 18 GHz, as is different from the case of rock fracture. The cause of the emission is esteemed to be charging and subsequent discharges.

(5) In particular time, we observed noises from environment. The signals, however, do not include 2GHz nor 18 GHz components.

4. Conclusion

All metallic parts in the destruction subsystem were electrically shorted to prevent emission due to discharge. Even so, radiation was observed in various rock cases so that the emission due to rock fracture is confirmed.

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Keywords: rock fracture, radio wave, metal contact, noise, parts, short