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Research Paper

PHYSICAL CHARACTERISTICS OF WAVE PROPAGATION IN SOIL MEDIUM

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This is study of the various physical character which involve with the wave propagation in the soil medium. This is the project which explains about the study of various factors in the soil medium wave propagation. Due to the rapid development in the field of mining, transport and geological studies are conduct in underground. The interface of sensors underground by wired is possible until an extend. Hence, the soil medium itself act as transmission medium. The efficiency of the signal is involved with the factors to be discussed.

Keywords: Wavepropagation, Soil medium, Physical characteristics

INTRODUCTION

The factors which is involved the soil medium wave propagation is

- Porosity
- Humidity.
- pH
- Ion concentration

ANALYZING INSTRUMENTATION

A434 RF Transceiver Module

The A434 rf transceiver is the device which is operating at the frequency of 434 MHz, which is in the better operation range in soil medium which is numerically calculated.

Figure 1: Apparatus Setup



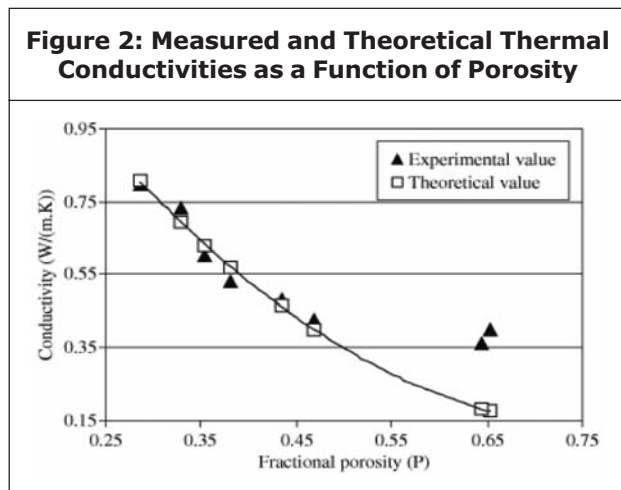
EXPERIMENTAL STUDY

Porosity

The porosity is the physical factor which involved in the size of the soil particles. But how it involves with the wave propagation. Here the distance

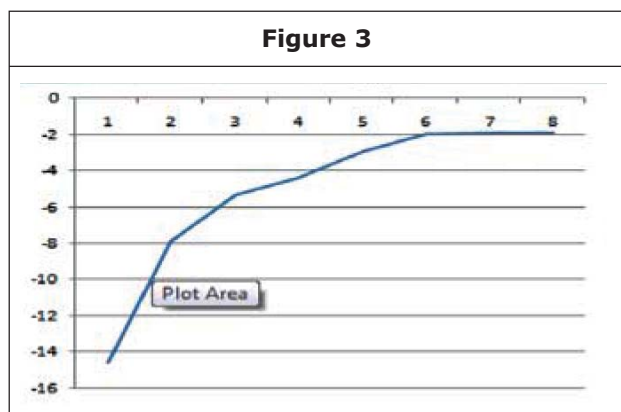
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between the particles decides the losses during the transmission, is both the thermal and ionic based. This is measured using the micron. The increase in porosity will decrease the power of signal. Granite is the medium has minimum porosity about 0.2 micron.



Humidity

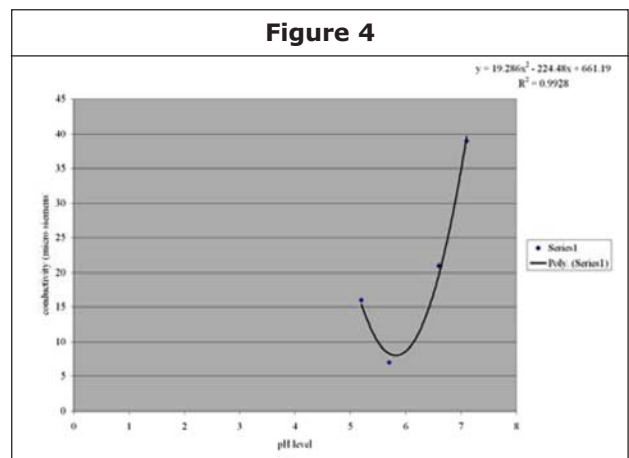
This is also the important physical characteristics of wave propagation where the amount of water molecules presence is proportionally increase the conductivity of the medium. This reduce the resistance of the medium which increase with conductivity. This shows the tangential rise of signal power in certain level and saturation for certain extent.



The optimal range for humidity is between 40 to 70% above the noise will degrade the signal.

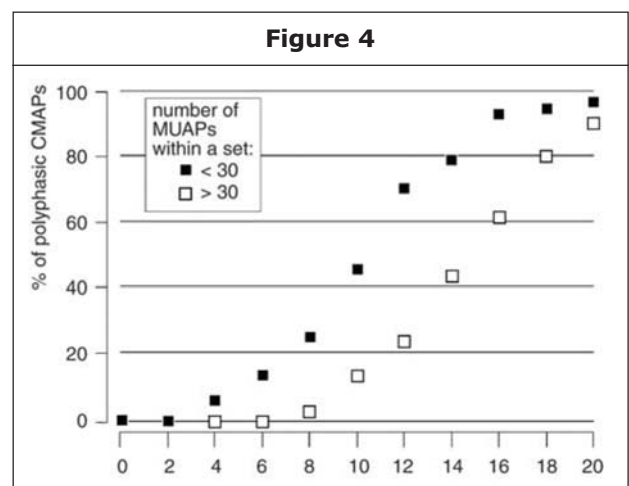
pH

Depending on pH of the soil the wave impedance can be altered. The conductivity is not uniformly increased or decreased throughout the graph. The conductivity either acidic or basic medium, it can be decreased while approaching the neutral. Hence, the signal must be better conductive in the edges of the value.



Ionic Concentration

The ionic concentration is the another factor which involve with the mineral and ions present in the soil medium.



This also involve the strength of the signal and signal to noise ratio the amount of ions is proportional to the conductivity of the signal. It is measured in Parts Per Million (PPM).

Wave Theory

The reflection coefficient is a parameter that describes how much of an electromagnetic wave is reflected by an impedance discontinuity in the transmission medium. It is equal to the ratio of the amplitude of the reflected wave to the incident wave, with each expressed as phasors. For example, it is used in optics to calculate the amount of light that is reflected from a surface with a different index of refraction, such as a glass surface, or in an electrical transmission line to calculate how much of the radio wave is reflected

by an impedance. The reflection coefficient is closely related to the transmission coefficient. The reflectance of a system is also sometimes called a "reflection coefficient". Here the change in the medium cause impedance mismatching.

CONCLUSION

Thus the physical factor involved in the wave propagation medium is studied and analyzed. Hence, the physical characteristics of the soil medium wave propagation is concluded.

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Factor	Optimal Range
Humidity	40 to 70 percent
pH	Edge values
Porosity	< 75micron
Ionic concentration	>1000ppm



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