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Basic studies of dielectric dispersion for remote observation of H2O-containing rocks: (I) ion-doped quartz, etc

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Strong dielectric dispersion has been reported on rocks containing even a very small amount of water.

We introduce the preliminary study on the dielectric property and its mechanism in simple model materials to clarify the dielectric natures of wet rocks, since such dispersion is expected to provide us with a powerful clue to explore H2O in the deep crust of the Earth by means of remote observation.

Complex dielectric permittivity is generally represented by e* = e +is/w, where e is an dielectric permittivity and s is electric conductivity. The peculiar features in wet rocks are; (1) e is extremely large up to 10^-6 (corresponding to dielectric constant of 10^5) or more at the frequencies lower than ~kHz, whereas it is usually almost constant below 10 for dry rocks; (2) e appears to be inversely proportional to frequency, whereas s is nearly constant over the wide range of frequency for wet rocks. We note that no reasonable explanation on the mechanism has been provided to account for the features mentioned above to our knowledge and that no experimental and theoretical justification exists to show the large dielectric dispersion in wet rocks under the physical condition of the deep crust. In this paper we propose a theoretical model to explain the known property and the experimental study to check the model and also to clarify the actual nature of dielectric dispersion.