The Dielectric Constant of Japanese Coal (Preliminary Report)

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Although numerous investigations have been undertaken into the physical properties of coal, little information exists concerning its dielectric constant.[1,2] In the present note the writers wish to record some results of their dielectric measurements on various sorts of Japanese coal.

Each of the test pieces of this experiment was cut from the vitreous portion of a large block of coal specimen and then carefully made into the form of a circular plate of about 4 cm. in diameter.* The test pieces thus prepared were kept in desiccators over phosphoric anhydride for three or four months. These pieces were considered to be dry, when their dielectric properties remained unchanged with further desiccation. The dielectric constant and power factor were measured by use of a bridge circuit for frequencies up to 20 kc./s. and a Q-meter for the frequency range 50 kc./s.-50 Mc./s.

The dielectric constant, ε, and power factor, $\tan\delta$, of two representative samples (bituminous coal) are shown in the accompanying figure. It will be seen that there is no anomalous dispersion of distinct sort: it

would be inferred that there is practically no dipole rotation and further that there is no such heterogenity as would produce the dispersion of the Maxwell-Wagner type.[3] The latter point may be important in connection with the Ellis's view[4] that in a bituminous coal there exist crystallities of graphite structure, these units being supposed to be different in electric conductivity o their surroundings.

As the refractive index of European coal for the visible light is between 1.7–2.0[5], the dielectric constant recorded here is believed to be slightly larger than the square of the corresponding refractive index. Further, the power factor of coal is found to be small and near to those of insulating materials. Therefore, it may be said that Japanese coal behaves almost like nonpolar substances: that is, it is mainly composed of nonpolar molecules, or its polar groups are almost completely hindered from rotation.

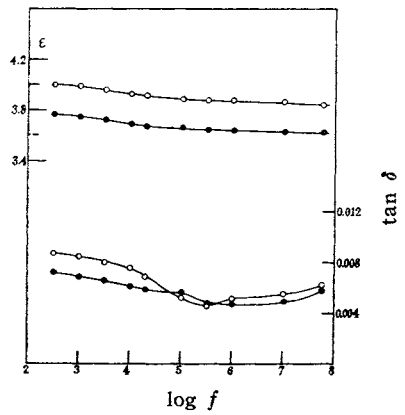

Fig. 1. The dielectric constant and power factor of two specimens from Hokkaido coal-mines: ○ From Bibai-Bed, Moziri; ● From Wakanabe-Bed, Akabira.

Full discussion of the experimental results as well as complete description of the experimental method will be presented in subsequent papers.

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1) I. Miyasita, *Bull. Res. Inst. Appl. Elec.*, 5, 123 (1953).
2) I. Miyasita, ibid., in press.
3) K. Wagner, *Arch. Elektrotech.*, 2, 371 (1914).
4) C. Ellis, *Proc. Roy. Soc.* (London), **212A**, 1 (1952).
5) D. W. van Krevelen, *Brennstoff-Chem.*, **34**, 167 (1953).

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