We stated " U-effect II " in the previous paper. When we apply the " maximum power transfer theorem " (Impedance matching) to this, a new method of capacity measurement can be introduced. When, generating an alternating current by the mechanical vibration of mercury-solution interface in a glass capillary (this we call " element ") ...... U-effect II ...... , we change the load impedance, we can observe a peak in the power-load curve, where " power " means what is supplied to the load by the vibrating element. According to the maximum power transfer theorem, the inner impedance of the element and the outer impedance of the load have the same absolute value at this maximum. From this value we calculate the capacity of the interface.

With this method we measured the capacity of mercury-norm. H_2SO_4 aq. interface to be 20.24 μF/cm². and that of mercury-norm. KCl aq. interface to be 16.02 μF/cm².

As the alternating voltage is generated by the charging and discharging of the periodically changing interface, we do not polarize the interface by an outer electromotive force. This is why our method is quite different from the impedance bridge method, in which case capacity observed is the differential capacity, because the alternating electromotive force in the circuit polarized the interface periodically. Our method is also different from the direct method, because the charging and discharging current are not measured directly. Accordingly we can research the interfacial structure from the view-point of circuit theory by this method.

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15. Study on High Dielectric Constant Ceramics. (VI)
Polarization of BaTiO₃ Ceramics.

Kiyoshi Abe and *Tetsuro Tanaka.*

Various values regarding the polarization of $BaTiO_3$ ceramics can be obtained from the static measurement by a ballistic galvanometer under proper conditions, as well as the dynamical method by a Braun tube oscilloscope. It is necessary, in these static method, to remove completely the hysteresis of $BaTiO_3$ specimen before measurement, to get reproducible values of polarization. The hysteresis, however, is easily removed when the sample is heated above its Curie point, and both electrodes are short-circuited. Then the dielectric polarization Pc and Pd which correspond to charging and discharging quantity respectively, and residual polarization Pc-Pd, can be readily obtained. It is also possible to get residual polarization directly from the measurement of exhausted electricity when the specimen is rapidly heated above its Curie point. The measured value of residual polarization Pr by this method usually shows fairly good agreement with that of Pc-Pd.

Pc and Pd increase with field intensity, and there appears a tendency of saturation at about 7,000 V/cm. The values of Pc and Pd at 20,000 V/cm are about 9 and 4.5 μ Coulomb/cm² recpectively, and it is shown that there rimains about half of Pc after the field is removed. A similar result is obtained from the measurement of Pr.

. The temperature characteristics of Pc, Pd and Pr, show that Pc and Pd take same values above Curie point, and Pr becomes zero near the same temperature.

The relations between the values of Pr and the time of exposure to field from 10^{-2} to 10^3 sec., shows that Pr is very much influenced by time of exposure when field is comparatively small, but not so much at large field.

Coercive field was measured in the same manner, and it was found that it takes the value of about 6,000 V/cm at large field intensity.

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16. Study on High Dielectric Constant Cermaics. (VII)
Electrical Resistance of BaTiO₃ Ceramics.

Kiyoshi Abe and *Tetsuro Tanaka*.

As BaTiO₃ changes its crystal structure at Curie point, it is expected that there appears an abnormal change on electrical resistance of BaTiO₃ ceramics near this temperature. Below Curie point, the crystal has domain structure and suffer remarkable influence from applied voltage, so the influence of voltage on resistivity is also expected. Eperiments were carried out to confirm these expectations. Special cares were taken to avoid experimental errors due to the ferroelectric properties of such materials.

. The experimental result obviously shows the abnormal change of resistivity near the Curie point, and log R versus $1/T$ curve becoms two straight lines kink seperated at this temperature. Values of ΔE and R_0, calculated from the next formula, are summarized on Table 1.

$$R = R_0 e^{-\frac{\Delta E}{KT}}$$

Table 1.

Applied Voltage V/cm	ΔE_h. eV	ΔE_l. eV	$R_0 h$ Ohm–cm	$R_0 l$ Ohm–cm
1750	1.06	0.76	4.4×10^{-4}	66.7
8330	1.14	0.78	3.2×10^{-5}	1.5
16670	1.22	0.95	1.7×10^{-6}	6.1×10^{-3}

In Table 1, ΔE_h, $R_0 h$ ahd ΔE_l, $R_0 l$ are that above and below Curie point respectively.

Above Curie point, resistivity decreases with increase of applied voltage, which seems to agree with the properties of ordinary dielectrics. Below Curie point, on