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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 10581-2006

**Method of test for electrical resistance and resistivity of
insulating materials at elevated temperatures**

(English Translation)

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1 Scope

This standard specifies methods for the determination of insulation resistance and volume resistivity of insulating materials, at 800 °C and below.

This standard applies to the determination of the resistance of insulating materials, which have high temperature resistance.

2 Normative references

The provisions in following documents become the provisions of this Standard through reference in this Standard. For the dated references, the subsequent amendments (excluding corrections) or revisions do not apply to this Standard; however, parties who reach an agreement based on this Standard are encouraged to study if the latest versions of these documents are applicable. For undated references, the latest edition of the referenced document applies.

GB/T 1410-2006 Methods of test for volume resistivity and surface resistivity of solid electrical insulating materials (IEC 60093:1980, IDT)

GB/T 10064-2006 Methods of test for the determination of the insulation resistance of solid insulating materials (IEC 60167:1964, IDT)

GB/T 10580-2003 Standard conditions for use prior to and during the testing of solid insulating materials (IEC 60212:1971, IDT)

3 Preparation of electrodes and specimens

When measuring insulation resistance, the specimen can be of any suitable size and shape, as shown in GB/T 10064-2006. When measuring volume resistivity, it is best to use a circular plate specimen and a three-electrode system. One of the electrodes is the protective electrode. The thickness deviation, at any two locations of the specimen, shall not be greater than 5% of the average thickness. The electrodes are preferably circular. The electrode is composed of a conductive coating, which is made by melting conductive paint OR by evaporating or spraying it on the surface of the specimen. Gold or platinum are suitable electrode materials. Silver cannot be used, because it migrates at high temperatures. Thin layers of gold can sinter at higher temperatures, thereby reducing conductivity. Evaporation or sputtering electrodes shall not be used, for porous specimens. In order to reduce the influence of the edge surface of the specimen, if the protective electrode is not used, it is recommended that the minimum distance, from the electrode to the edge of the specimen, is 5 mm.

4.1 Resistance measurement (see Figure 1)

The measurement shall be carried out, by a suitable device, whose sensitivity and accuracy meet the requirements (see GB/T 1410-2006).

4.2 Heating chamber

A suitable electric oven or furnace shall be used, to heat the specimen. Its structure shall enable the entire specimen to be heated evenly; the temperature fluctuation shall be as small as possible. Use a suitable heat shield, to shield the specimen, to protect the specimen from direct radiation from the heating element. The heat shield can be made of ceramic, such as alumina or similar materials. Install a grounded metal shield of silver, stainless steel or similar material, inside the oven, to prevent leakage currents, between the heating circuit and the measurement circuit. In the case of high resistance of the specimen, the heating element must be disconnected during the measurement, to avoid interference with the measurement.

4.3 Specimen holder

The sample shall be placed, closely between two metal electrodes, in the heating chamber. The metal electrode and its leads are made of metal or alloy, which has high temperature resistance, oxidation resistance, sufficient mechanical stability, such as stainless steel. In addition, the test can also be carried out in an inert gas; the two electrodes shall have sufficient thickness, to prevent warpage AND ensure that the temperature of the specimen is equal to that of the two electrodes. The size of the contact surface of the two electrodes is equal to the size of the electrodes on the specimen, wherein one of them can be moved, so that the specimen can be inserted or removed.

4.4 Measuring lead

In order to prevent leakage current from affecting the test results, an insulated measuring wire is used, to enter the heating chamber, through a high-resistance ceramic insulator. The insulator shall be in a cold area AND shall be properly protected.

Note: It is also possible to introduce wiring, through the holes on the furnace top or furnace wall (the furnace body shall be grounded). If a hard wire is used for wiring, the wire can be attached to the support; the wiring only contacts the support, which is relatively cold AND can be made of any hard insulating material.

4.5 Temperature control

A temperature control measure shall be adopted. The temperature tolerance shall be in accordance with the requirements of GB/T 10580-2003. It is recommended to use two thermocouples or thermometers, one of which is placed in the heating chamber, to control the temperature, the other is used to directly measure the temperature of the specimen.

The thermocouple, which is used for measuring the temperature of the specimen, shall be placed as close as possible to the specimen, so that there is no electric field interference, when measuring the resistance. For example, a thermocouple can be inserted directly into a hole in the electrode; the bottom of the hole is as close to the specimen as possible (see Figure 1). Holes can be drilled on the opposite side of the electrode, which is perpendicular to the surface of the specimen, OR on the side of the backing plate, which is parallel to the surface of the specimen. When the thermocouple is installed in the electrode, it must be well insulated; otherwise, the thermocouple shall be disconnected or taken out, during measurement.

4.6 Key points during measurement

The measurement will be impacted by the reduction of the insulation resistance, due to the heating of insulation of the wiring in the oven. Since the loop, between the current measuring instrument and the power supply, is grounded (both sides of the specimen are insulated to ground); if a small current loss is formed on the power supply, the conductance, between the high potential wiring and the ground potential, can be neglected. The conductance, between the low potential wiring and the ground potential, forms a shunt, which is in parallel with the current measuring instrument. The resistance to ground of the measuring electrode shall be 10 ~ 100 times higher than the input resistance of the current measuring meter (for the most sensitive current measuring meters, the input resistance can be as high as 10¹¹ ohm). The leakage resistance must be measured separately, at each temperature. If different metals are used, on the wiring and the electrode frame, the thermocouple potential, between the different metals, can cause measurement errors. If using a short circuit to replace the power supply, the measurement current can indicate size

of the thermocouple's potential effect.

5 Conditioning

Specimen's conditioning is as specified by the material specification, OR it is selected from the conditions listed in Table 1 of GB/T 10580-2003.

6.1 Continuous heating (method A)

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