2. The Influence of the Melting Conditions on the Running Quality of Aluminium

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Molten aluminium tapped out from the electrolytic furnace is often held in the holding furnace for a long time before casting ingots. It is important to know the influence of the holding time and temperature on the properties of molten aluminium. In this experiment, the running quality of molten aluminium is measured under the various melting conditions.

The measuring apparatus of a smaller size than the previous one [Sawamura and Morita, Memoirs of College of Engineering, Knoto Imperial University. 11 (1943), No. 2, 15; Nippon Kinzoku Gakkaishi, 7 (1942), 28.] is used. Although the downgate and the cross section of the measuring canal in this apparatus have just the same dimensions as the previous apparatus, the dimensions of all other parts are reduced so that the apparatus may be easily handled by one operater and the molten metal to be used in the test may be saved. The length of the measuring canal is 60 cm and the weight of the whole assembly is 10 kg. It should be noticed that, though the hydrostatic head is decreased from 15.7 cm to 7.9 cm, this apparatus gives the same length of flow as the prevsous one and very good reproducibility (± 1 %). The method of the preparation of the test mould are the same as the previous experiment.

About 350 gr of aluminium (99.67 %) is melted in a graphite crucible, heated up to the maximum heating temperature, 850°C, 800°C and 770°C respectively, in 15 minutes after melting down, held at those temperatere for 0, 0.5, 1, 1.5, 2, 4, 6, 8, 10, 12, 16, 20 and 24 hrs., and then poured into the sand reservoir having a graphite stopper. The pouring temperature is 710°C.

The results obtained are as followings. The running quality of molten aluminium is better in the order of maximum heating temperature, 800°C, 850°C and 770°C, and in each case, increases at the holding time between 0.5 and 1 hrs., and decreases at about 1.5 hrs., and tends to increase with further holding time, but there isnot so remarkable difference between them.

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3. Study on High Dielectric Constant Ceramics. (VIII) $BaTiO_3$ Single Crystal

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Single crystals of $BaTiO_3$ have been investigated by means of the polarization

microscope, and their dielectric properties were studied.

For growing $BaTiO_3$ single crystal, $BaCl_2$ is usually employed as flux. But in our laboratory, Na_2CO_3 was used with the relative proportion of one mole Na_2CO_3 to 0.20~0.26 mole $BaCO_3$ and TiO_2. The crucible in which the growth take place, should preferably be of pure platinum. But for the sake of its cost, we were obliged to use nickel crucible. To avoid its oxidation at high temperature above 1000°C, it was heated in the reducing atmosphere, being covered with graphite.

Good results were obtained by cooling the molten substance from 1100°C down to approximately 850°C within more than ten hours. Dissolving Na_2CO_3 in water, crystals with linear dimension from 0.1 to 2.0 mm are rapidly separated. Crystals grow in the form of cube or flat plate, and yellowish or brownish colored.

Under microscope, crystal is devided into regions shaded by fine parallel lines, oriented at an angle of 45° or parallel to the cube edges. Observing the crystal between crossed Nicols, it shows parallel extinction.

To investigate the dielectric properties, silver electrode were fired on both parallel planes of cubic crystal. The dielectric constant at room temperature varied widely between individual crystals from about 800 to 2000. The temperature, at which the dielectric constant has maximum value and the shape of temperature characteristic curve also varied between individual crystals. This may be due to the impurity unexpectedly included into crystal. There was found generally a large hysteresis in the temperature curve between temperature ascending and decending, which will be perhaps due to internal strain.

The dielectric constant is much influenced from applied field and D. C. biasing field. But these characteristics also shows the existence of individuality according to crystals, and no uniform results were obtained.

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4. Study on High Dielectric Constant Ceramics. (IX)

Application of Piezoelectricity of $BaTiO_3$ Ceramics for Phonograph Pickup

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The electrostrictive and piezoelectric properties of $BaTiO_3$ ceramics have been experimentally studied by the writers in previous report (IV). $BaTiO_3$ cermic has permanent piezoelectricity below the Curie point, and its sensitivity shows neglegible change between-70°C and 70°C, independent of humidity effects. The possibility of firing the silver electrode on its surface, in combination with upper excellent properties, makes it an ideal material for use in phonograph pickups.