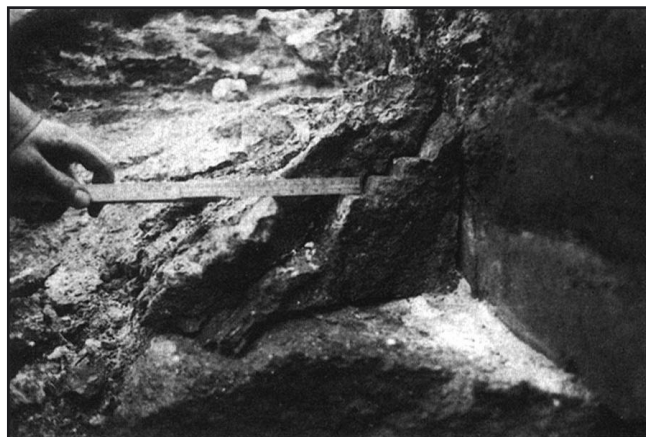


Rammability of Paste

Introduction

Ramming paste is used between the blocks at the bottom of the aluminium electrolysis cells. It is important that the paste has the right granulometry and consistency. Too dry paste will give too low density, while too wet paste does not adhere in the ramming operation. In addition, specific properties of the ramming paste are required to guarantee a lining free of cracks through which liquid aluminium or liquid electrolyte may flow. Otherwise a rapid destruction of the carbon blocks in the bottom and sidewalls of the electrolysis cells may be observed.



Test Method and Results

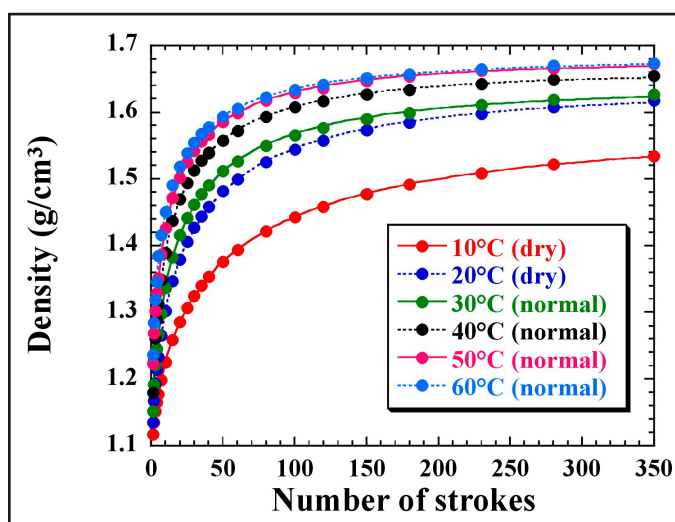
The determination of the rammability is a measure to define optimum conditions for baking. A laboratory rammer is used to determine the compaction curve for ramming pastes used in the lining of cathodes in the production of aluminium.

A total of 350 impacts are applied. The density of the paste versus number of impacts is measured. The data is curve fitted to a three parameter cumulative Weibull distribution function. A ramming parameter, N_2 , is obtained as the number of impacts where the second derivative of the Weibull function has its minimum. An alternative method is to determine the density after 50 strokes divided by the density after 100 strokes, d_{50}/d_{100} .

The compaction behaviour of a "dry" paste is characterised by a slow approach towards its asymptotic density value, a value that may not be reached even after prolonged compaction in the rammer. The risk of crushing the grains is high.

A "wet" paste is characterised by a rapid increase in paste density towards the asymptotic upper density value, d_{max} .

For the "normal" paste the compaction characteristics are between the extremes above. The density approaches d_{max} after prolonged compaction in the rammer after approximately 300 impacts.



Experimental

The rammer used in this test consists of a steel cylinder, a pedestal, a steel piston, a weight and a height measuring device with an accuracy of 0.1 mm as shown in the Figure. The steel cylinder has an inner diameter of 50 mm. The height of the rammed test specimen after the test shall be equal to the diameter of the test specimen ± 5 mm.

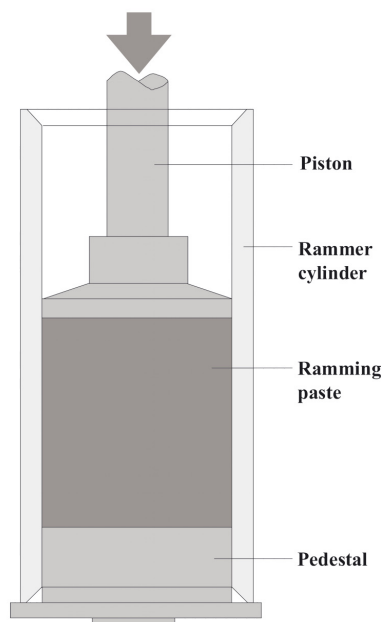
The ramming paste is heated in a heating cabinet maintained at constant temperature (± 0.5 °C) in the range 5 - 100 °C.

The ramming paste is compacted in the rammer by 350 impacts at a rate of about 1 impact per second. The impact applied should be constant at 0.3 MPa/cm².

The height of the test specimen is recorded from the scale during the ramming. The temperature of the paste should be maintained as constant as possible during the ramming.

Test report includes:

- identification of the test specimen
- the results of the test:
 - a curve of density versus number of impacts
 - a list of the curve fitted parameters from the Weibull function and the N2 value
- or
- the d_{50}/d_{100} value
- details of any unusual observations



Reference:

M. Sørli and H.A. Øye: "Ramming Pastes for Aluminium Cell Cathodes: Quality Criteria, Testing Procedures and Installation Practice." Xth Int. Symp. on Carbon and Graphite Materials, Racibórz, Hungary, Sept. 22-24, 1993. Extended Abstracts, 24-27.

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