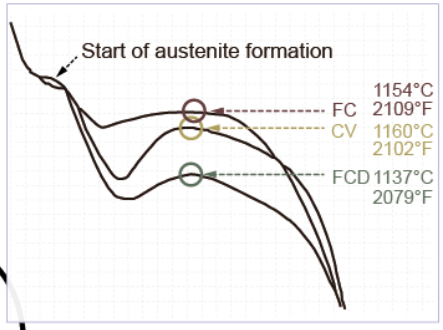
SGR-*Win*

Technical Note & Users' Manual

Calibration curve is automatically corrected by inputting data.

Nodularity of FCD and CV is measured (SG%)

Touch panel type (15 inch).



precision ±5%

Data saved for three years

Past record can be referred.

Experimental results suggest the following factors to be important for nodularity improvement.

1. Properties of the original melt before Mg treatment.
2. Performance of Mg treatment and inoculation.If eutectic solidification is above 1150° C (2102° F), improper Mg treatment and hence, insufficient nodularity may be suggested. If eutectic solidification is between 1130 and 1135° C (2066 and 2075° F), well-grown nodular graphite may generally be expected.
3. Chemical composition of the melt, including carbon equivalent and minor residual elements.
4. Casting section thickness.
5. Pouring temperature, time before pouring, and other process variables.

NAKAYAMA CO.,LTD.

Technical Note on SGR-Win

A new type thermal analysis SGR-Win was developed based on our careful experiment on 280 data sets extracted from past record, which had 90% to 95% correlation between MgCup data and MgTP data, namely thermal analysis data and structural data. The results of the study were used for the design of the instrument and are summarized in the following.

Important phases in spheroidal graphite cast iron are austenite, graphite, and carbides, among which graphite shape is most critical. 280 tests were made where both MgCup and MgTP of 20 mm diameter and 80 mm height were poured from the same melt. Thermal analysis and structural analysis were performed to obtain correlation between the results of the two analyses.

It was found that when magnesium treatment is inappropriate eutectic solidification temperature is generally around 2102° F.

If eutectic solidification temperature is around 2069°F, well-developed spheroidal graphite is observed. If the temperature is lower than this level, primary carbide tends to nucleate.

A number of variables is related to development of proper number of spheroidal graphite with desirable spherical shape. Most important among them are:

1) Properties of the original melt before magnesium treatment, in relation to fading.

2) Performance of magnesium treatment and inoculation.
   Supposing a melt is treated with magnesium and then inoculated, and if eutectic solidification is above 1150°C (2102°F), improper magnesium treatment and hence, insufficient nodularity is suggested.
   If eutectic solidification is between 1130 and 1135°C(2066 and 2075°F), well-grown nodular graphite may generally be expected.

3) Chemical composition of the melt, including carbon equivalent and minor residual elements.

4) Casting section thickness.

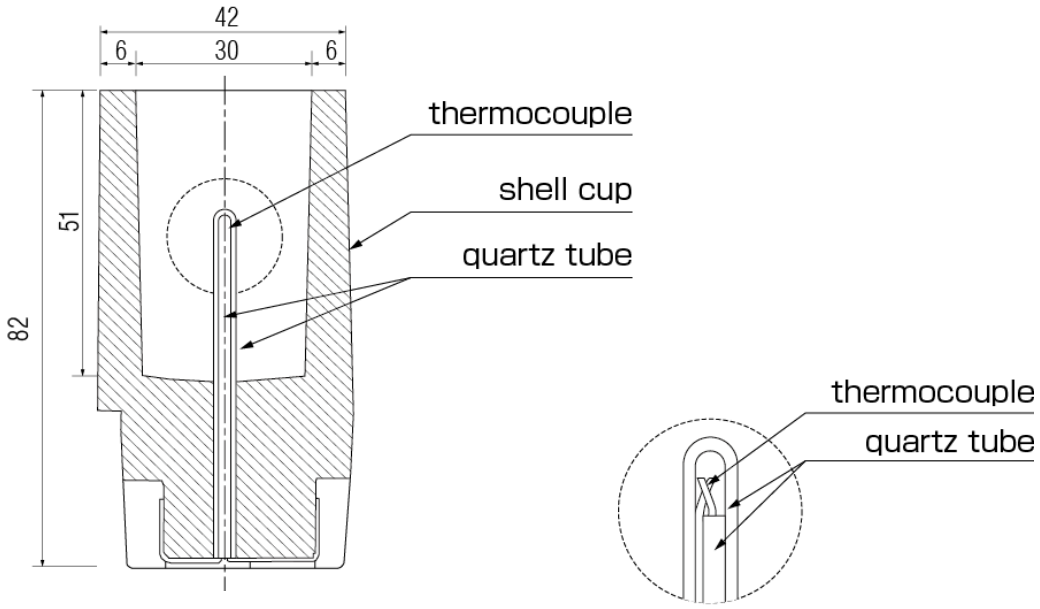
5) Pouring temperature, time before pouring, and other process variables.

Shape of a cooling curve obtained by a thermocouple placed at the center of a cast iron sample depends on the characteristics of the melt. The shape of the cooling curve, supercooling, maximum eutectic temperature, and end of solidification are closely related to formation of phases such as carbides, vermicular graphite, A-type, D-type, or E-type flake graphite, or nodular graphite.

A cooling curve is a reflection of cooling speed of a sample depending on evolution of latent heat and sensible heat in relation to heat extraction by the mold.

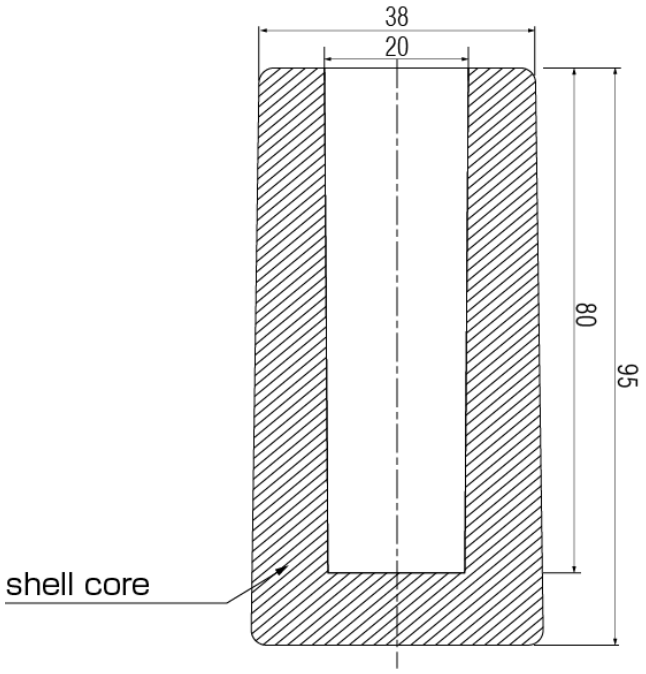
Samples were taken from a treatment ladle or a pouring ladle and poured with a ceramic fiber spoon or small ladle. Shapes and dimensions of the MgCup and MgTP are shown below.

MgCup section



MgTP section

size:20φmm×80Hmm shell mold



Among the characteristics examined in the experiment, emphasis was placed on the maximum eutectic temperature and latent heat at solidification.

The maximum eutectic temperature was found to be the best measure indicating the appropriateness of magnesium treatment.

Because characteristic points of thermal analysis and shape of cooling curve are closely related to types of graphite formed, thermal analysis can be used for graphite shape prediction with a reliable probability.

It should be kept in mind that nodularity may vary depending on the type of spheroidization treatment adopted by each customer. Precision of prediction can be improved by accumulating data in the customer’s own plant for better correlation of thermal analysis and microstructure.