Digital Computer Laboratory
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SUBJECT: HYSTERESIS LOOP CHARACTERISTICS OF MF-1118 FOR DIFFERENT TEMPERATURES

To: Group 63 Staff

From: Channing Morrison

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Abstract: The hysteresis loops were obtained in a temperature range from -196 degrees Centigrade to +305 degrees Centigrade. The Curie point of MF-1118 was reached at approximately 305 degrees Centigrade, and the maximum Squareness Ratio occurred at approximately 30 degrees Centigrade. The flux density and the coercivity were both a maximum at -196 degrees Centigrade and both decreased with increasing temperature.

Type of Cores: The cores used were MF-1118 (F-259, 1-14-52). Four cores were wound together to provide enough output voltage to facilitate taking readings on the hysteresograph. This was made necessary since the wire used was #29 glass-insulated enameled wire and a total of only 18 secondary turns could be wound on the cores.

Type of Magnet Wire: A special type of magnet wire had to be found for this experiment because the insulation on Formex and Teflon wire could not withstand the high temperatures of the experiment (305° C). The wire used was a single glass enameled, #29, with a diameter of .0113 mils.

Temperature Control Material: The heating apparatus consisted of a small stove, a pyrex beaker, some Dow-Corning #550 Silicon Fluid, and some asbestos paper insulation.

The cooling apparatus consisted of ice, dry ice, a combination of dry ice and alcohol, dry ice and acetone, and liquid nitrogen.

Procedure: The apparatus was set up so that the heating equipment could be used for both the saturation loop and the squareness ratio tests.

For the squareness test, the temperature was raised to 255° C, and readings were taken at that temperature. Then the liquid was allowed to cool down and more readings were taken at 20-degree intervals. The lowest temperature taken without coolants was 26° Centigrade.

Then the saturation loop test was started and at room temperature enough ampere turns were impressed on the cores so that a hysteresis loop far into saturation was made. This loop was calibrated so that both the flux and coercivity could be read off the scope. The gain controls were set at this calibration and pictures were then taken at room temperature. The temperature was then increased in increments of twenty degrees and pictures were taken at these points. This procedure was continued until a temperature of 305° C was reached. This concluded the high-temperature part of the test.

The cooling apparatus was set up and ice was used to cover the interval between 26° and 0° Centigrade. Three points were taken for the maximum squareness curve in this interval. For the next lower temperature range, dry ice with acetone was used and a temperature of -55 degrees Centigrade was reached. Finally liquid nitrogen was used and a temperature of -196° C was reached.

This same cooling material was used for the saturation loops and readings were taken at 0°, -6°, -58° and -196° C. However, for the last two temperatures, the scale for the flux and coercivity had to be changed because the core was no longer into saturation at those temperatures and more ampere turns had to be added.

The data were read off the pictures and tabulated. Then the cores were unwound and the dimensions of the four cores were taken with a Vernier Caliper. From the dimensions of the four cores, an average was computed. Using this average core, the mean path length and cross-sectional area was determined. With these dimensions, the approximate coercivity in oersteds and flux density in gauss was computed and finally all the data were plotted in three curves: Coercivity vs. Temperature, Squareness Ratio vs. Temperature and Flux Density vs. Temperature. These curves are shown in Figures 3, 4, and 5. An arrangement of the pictures of the Saturation Hysteresis Loops are found in Figures 1-1, 1-2, 1-3; and pictures of the Maximum Squareness Loops are in Figures 2-1 and 2-2.

Signed Channing D. Morrison
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Approved DRB
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CDM/jk

Drawings Attached:

Figure 1-1	A-52702
Figure 1-2	A-52714
Figure 1-3	A-52715
Figure 2-1	A-52736
Figure 2-2	A-52737
Figure 3	A-52684
Figure 4	A-52685
Figure 5	A-52686

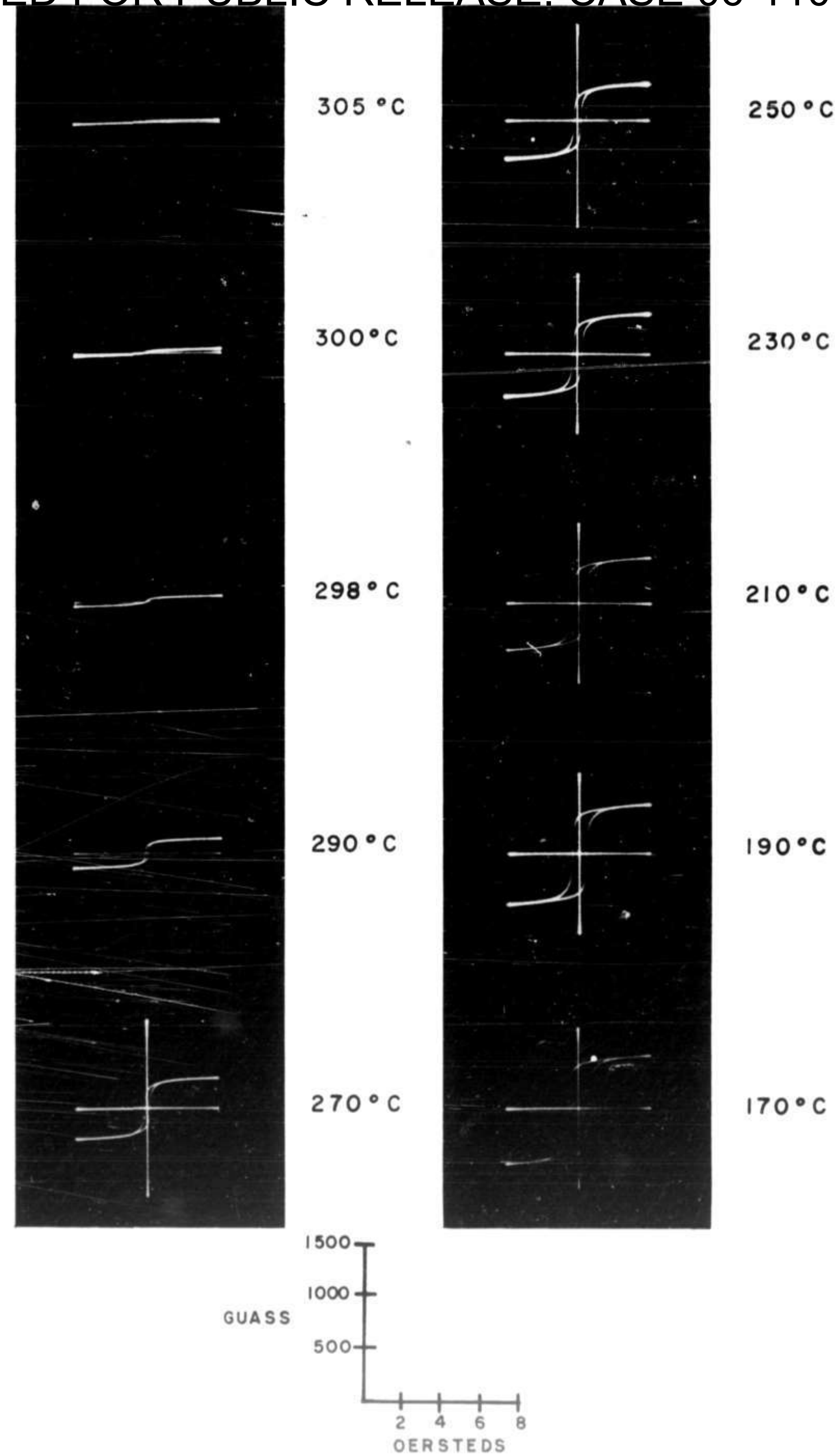

FIG. 1-1

SATURATION HYSTERESIS LOOPS OF MF-1118 [F-259, 1-14-52]
AS A FUNCTION OF TEMPERATURE

A-52702

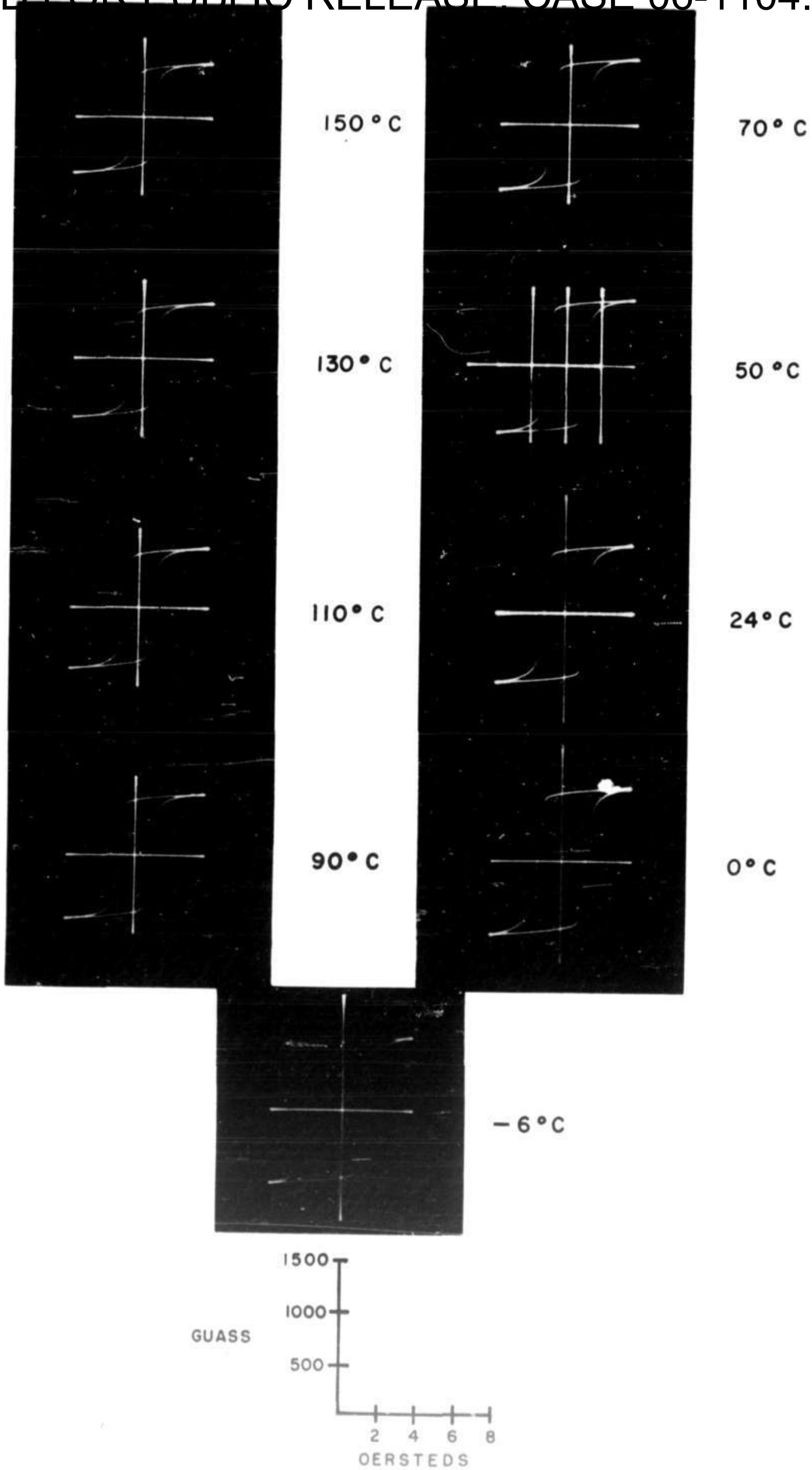

FIG. 1 – 2

SATURATION HYSTERESIS LOOPS OF MF-1118 [F-259, 1-14-52]
AS A FUNCTION OF TEMPERATURE

-52714

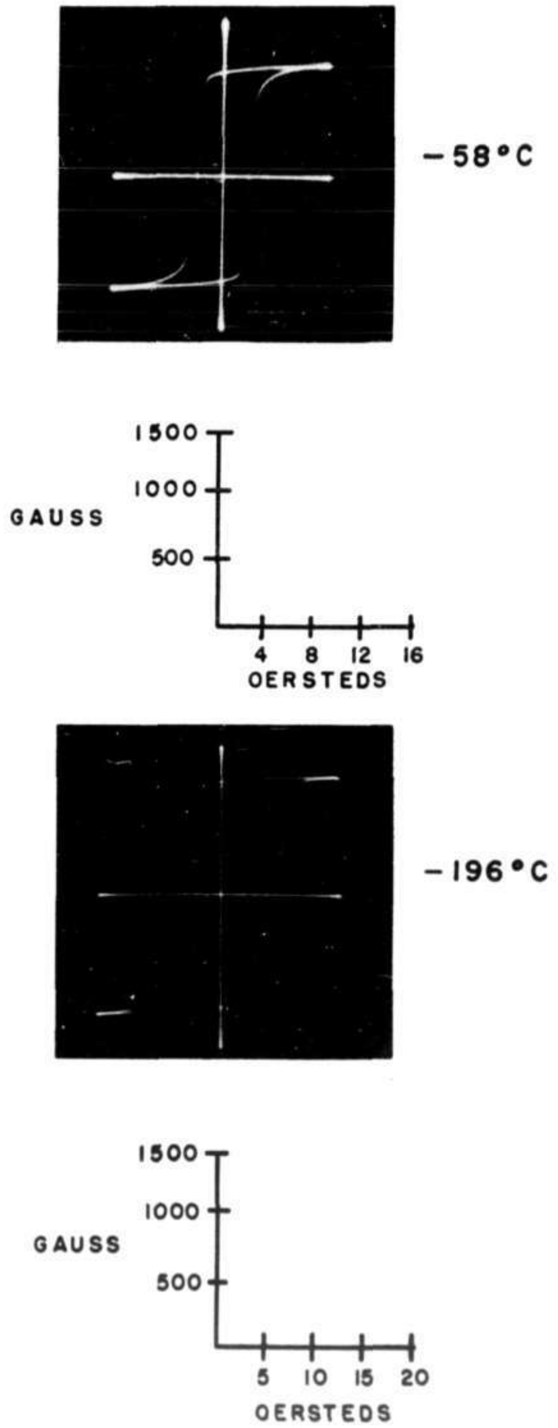

FIG. 1-3

SATURATION HYSTERESIS LOOPS OF MF-1118 [F-259, 1-14-52]
AS A FUNCTION OF TEMPERATURE

A-52715

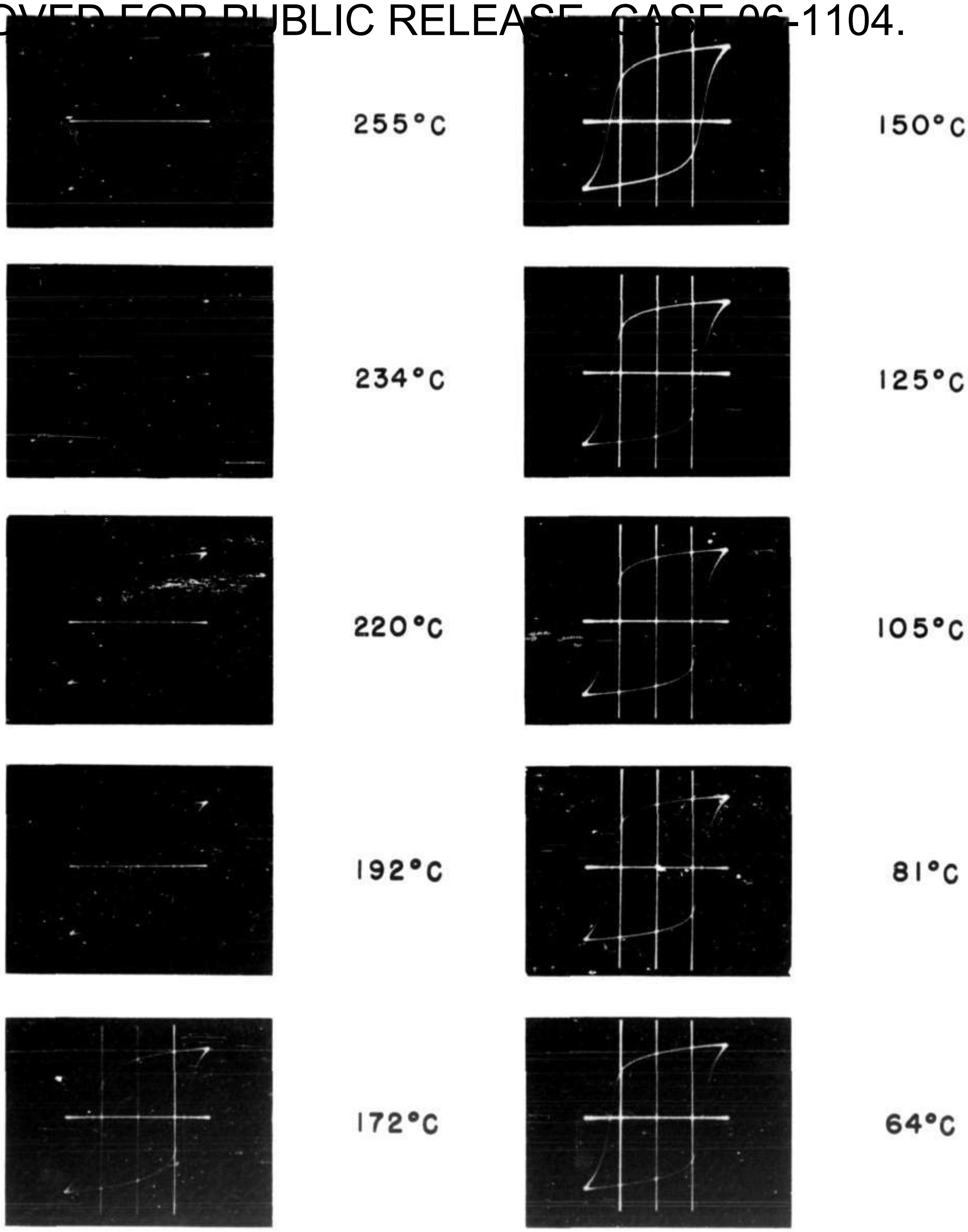

FIG. 2-1

MAXIMUM SQUARENESS RATIO OF MF-1118 [F-259, 1-14-52]
AS A FUNCTION OF TEMPERATURE

A-52736

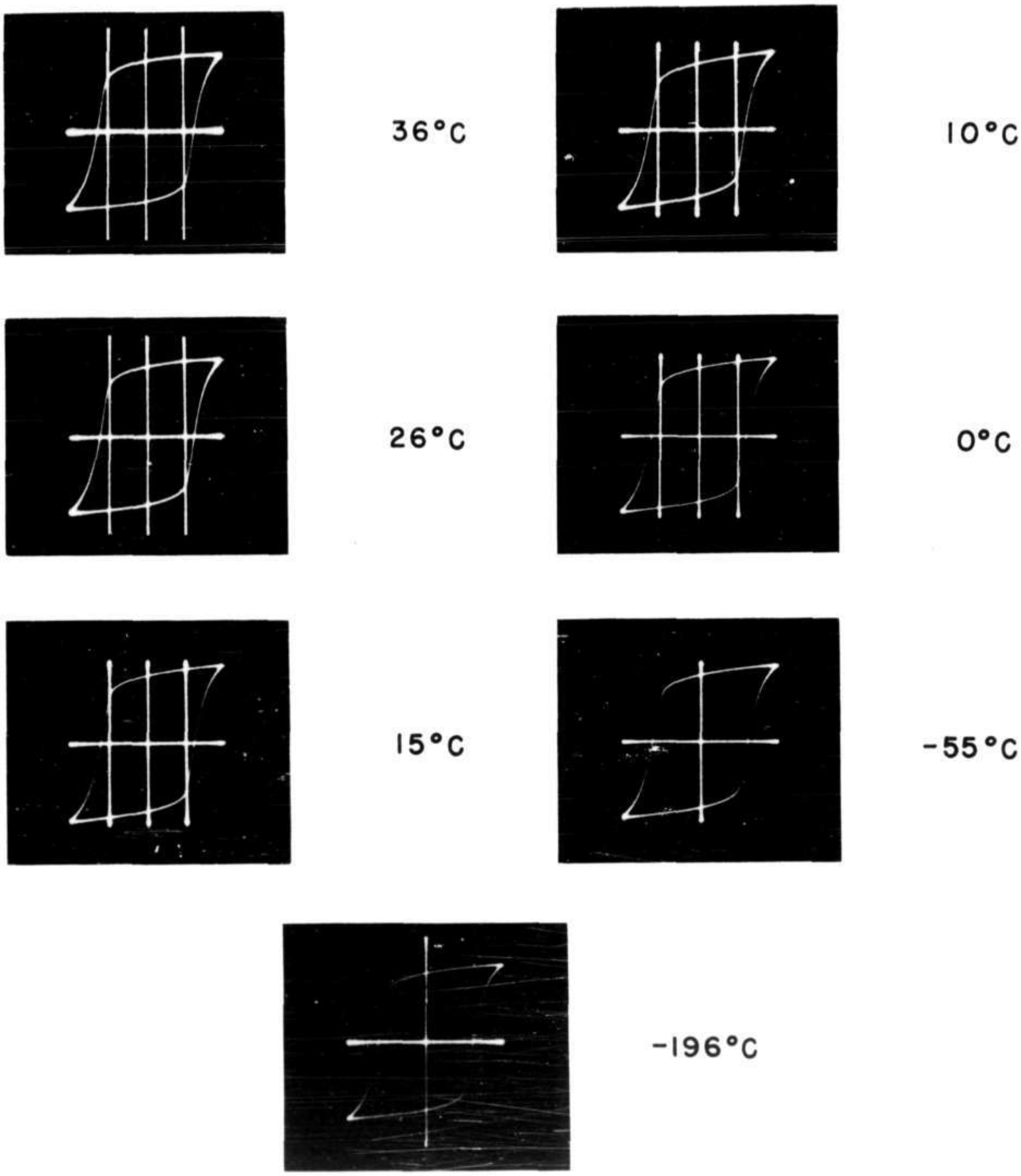

FIG. 2-2

MAXIMUM SQUARENESS RATIO OF MF-1118 [F-259, 1-14-52]
AS A FUNCTION OF TEMPERATURE

A-52684

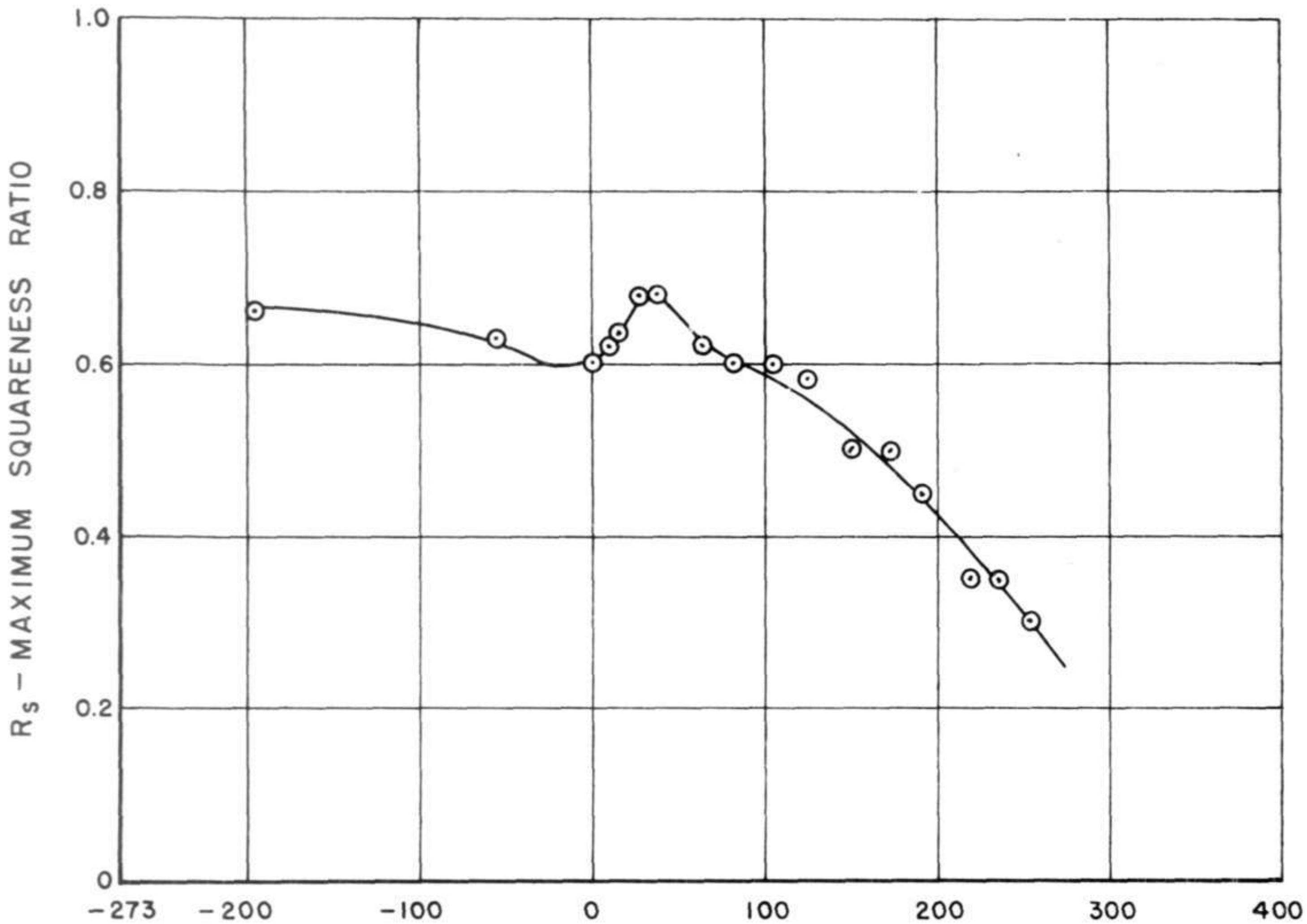

FIG. 3

MAXIMUM SQUARENESS RATIO vs. TEMPERATURE

4 CORES, MF-1118, F-259, 1-14-52

A-52685

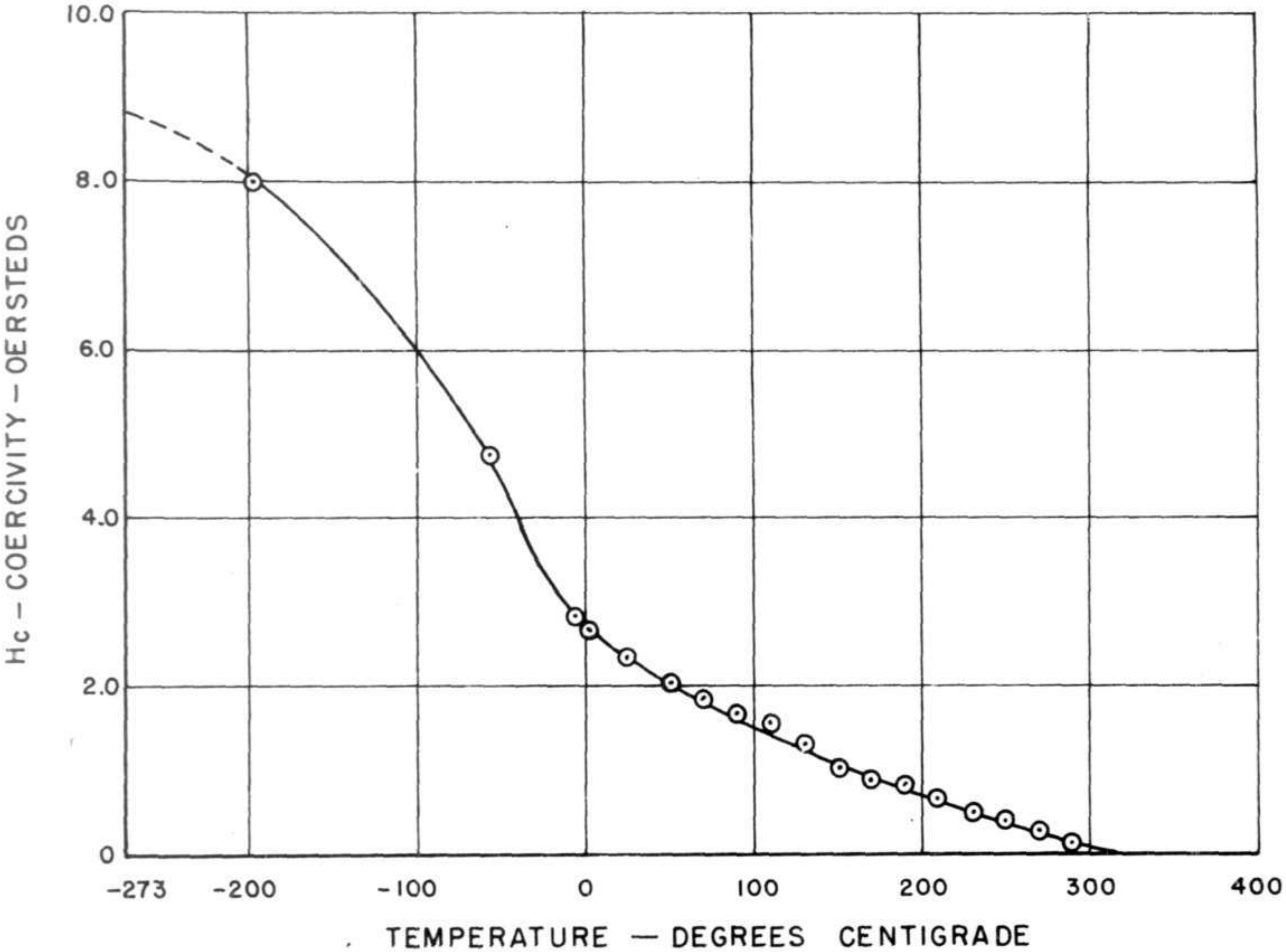

FIG. 4

COERCIVITY vs. TEMPERATURE

4 CORES, MF-1118, F-259, 1-14-52

A-52686

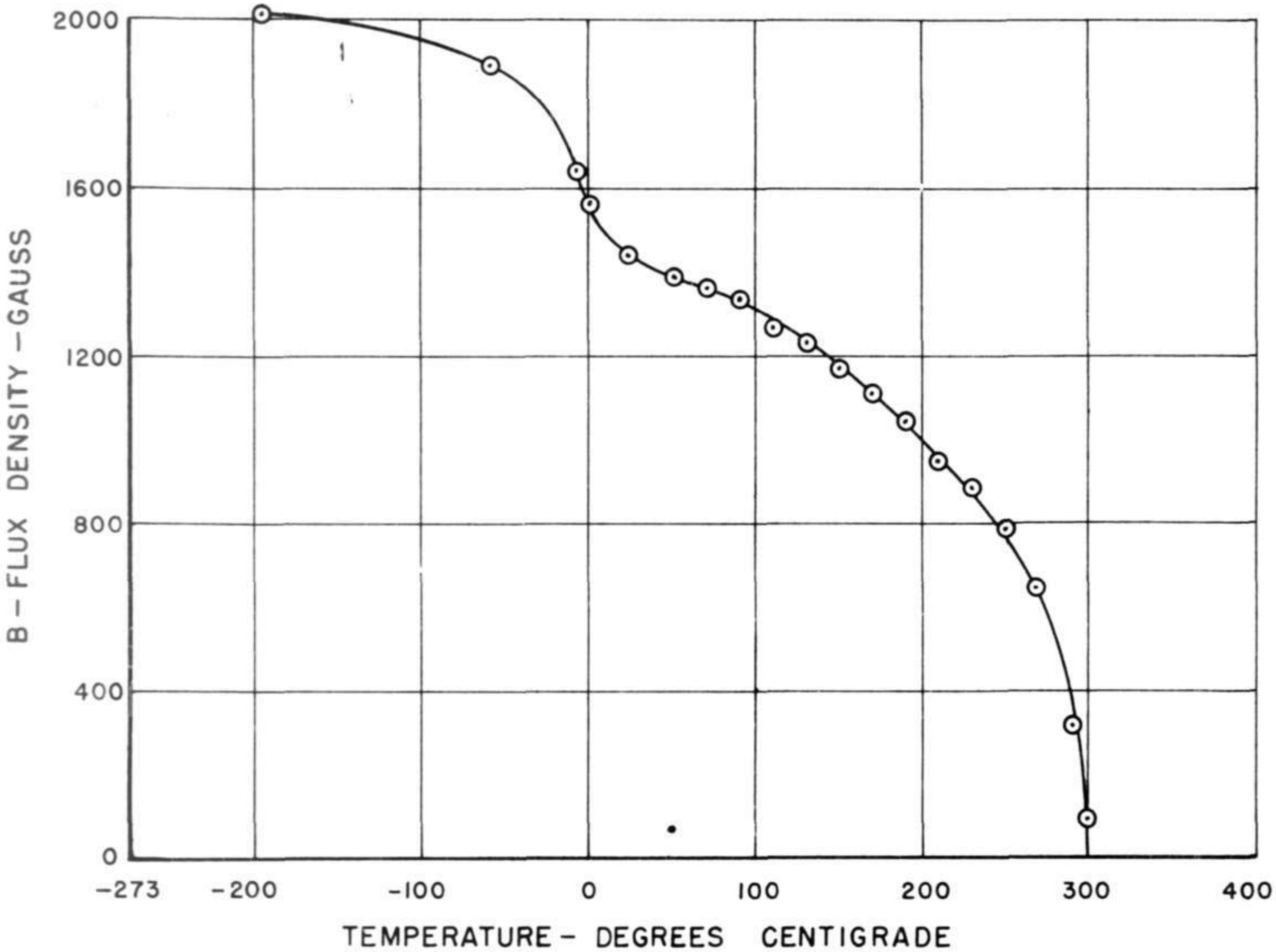

FIG. 5

FLUX DENSITY vs. TEMPERATURE

4 CORES, MF-1118, F-259, 1-14-52