

NATIONAL DEFENSE STOCKPILE  
PURCHASE SPECIFICATION

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INTRINSIC GERMANIUM METAL

I. DESCRIPTION

This specification establishes the requirements and tests for zone refined polycrystalline intrinsic germanium metal which could be used to produce optical grade germanium metal which can be fabricated into optical elements.

II. REQUIREMENTS

1. The germanium metal shall be zone refined and shall be capable of being converted into optical grade germanium metal for use over the spectral range from 2.5 through 14 microns.
2. Unless otherwise specified herein, the germanium metal shall meet the performance requirements at an ambient temperature of 19-26°C.
3. A production lot shall consist of 15 to 20 kilograms of homogeneous germanium metal packaged in one box. Every ingot in every production lot shall be inspected to determine compliance with the specification requirements. Any lot which fails to comply with any specification requirement shall be rejected.
4. The optical transmission shall be measured from 2.5 through 16 micron wavelength range. The optical transmission shall be measured through an uncoated, 10+1 mm thick sample polished planes parallel. The recorded transmission values shall equal the transmission values on the curve in Figure 1. A +2 percent transmission tolerance on the transmission value will be permitted.

5. The germanium metal shall have an electrical resistivity with a minimum numerical value of 50 ohm-centimeter at  $20 \pm 0.5^\circ\text{C}$  (40 ohm-centimeter at  $25 \pm 0.5^\circ\text{C}$ ) over the entire ingot length.

6. The electrical conductivity type shall be N-Type over the entire ingot length.

7. The germanium metal shall be supplied in the form of a uniform trapezoidal ingot. The minimum length of the ingot shall be 43 centimeters and the maximum length shall be 56 centimeters. The minimum diagonal cross section of the ingot shall be 25 millimeters and the maximum diagonal cross section shall be 63.5 millimeters. The "tail" end (the end last to freeze) of the ingot shall be cut perpendicular to the length-wise axis of the ingot.

8. The ingot shall be free of holes, inclusions, cracks, and chips.

9. The ingot shall be permanently marked in the middle of the top surface with the product name or chemical symbol, the ingot serial number, and name of producer. The producer name may be abbreviated with approval of the procuring agency.

10. After marking the ingot shall be chemically etched. The ingot shall be clean and of uniform color and quality.

### III. INSPECTION/SAMPLING/TESTING

The procuring agency will perform the following ingot inspection. Every ingot will be inspected for compliance with the visual and dimensional requirements of the specification. The ingots in a production lot will be sampled. The sample ingot will be tested for electrical properties. A  $10 \pm 1$  millimeter thick spectrographic sample will be removed from each sample ingot and tested for the optical properties.

Test Methods - The producer shall use the following test methods for ingot testing.

1. The transmission of the spectrographic sample shall be measured from 2.5 through 16 microns using an infrared spectrophotometer. The instrument 0% and 100% ( $I_0$ ) lines shall be recorded on the same graph as the sample transmission curve.

2. The electrical resistivity shall be measured using ASTM Standard F43, latest revision. The resistivity shall be measured on the clean bottom surface over the entire length of the ingot at one centimeter intervals. The two-point probe method shall be used for the resistivity measurement. The temperature at which the resistivity measurement is made shall be recorded.

3. The electrical conductivity type shall be measured using Method A, B, or C of ASTM Standard F42, latest revision. The conductivity shall be measured on the clean bottom surface over the entire length of the ingot at one centimeter intervals.

4. A visual examination shall be performed on each ingot to determine compliance with quality and marking requirements.

5. Each ingot shall be weighed using a scale capable of weighing to at least the nearest gram. The ingot shall be weighed after being marked, etched, and removal of spectrographic sample (if applicable), but before being placed in the polyethylene bag.

#### IV. PACKAGING/MARKING/SHIPPING

Ingot Packaging - The ingot shall be individually wrapped in a new clean transparent polyethylene bag which is a minimum of 0.004 inch thick. The bag shall be closed by heat sealing. After wrapping, the ingot shall be packaged in a manner that will prevent damage to the ingot during shipment.

Ingot Crating - The packaged ingot shall be tightly packed in a new wooden box with sufficient protective material to prevent damage to the ingot during shipment and storage. The ingots, packing material, and box together shall not exceed 55 pounds.

Wooden Box - The new wooden box with cleated ends shall be equal to the requirements of Type 3, Style 2, Federal Specification PPP-B-621, latest revision, Boxes, Wood, Nailed and Lock-Corner, except the minimum thickness of the sides, tops, and bottoms shall be 5/8 inch and the minimum thickness of the ends shall be 3/4 inch. After packing, the box shall be secured with steel bands equal to the requirements listed in the Appendix to PPP-B-621, latest revision. Holes shall be bored through each corner of the box in such a manner so that wire seals can be inserted by the procuring agency to ensure that the box is not opened without breaking the seals.

Box Marking - The box shall be permanently and legibly marked, in English, on both ends by attaching an embossed aluminum tag meeting the requirements of National Stockpile Identification Specification T-1, Tags: Aluminum, Embossed, current revision, except for the marking requirements. The box shall be marked with the following information:

Name of Product  
Name of Producer  
Country of Origin  
Production Lot Number  
Number of Ingots  
Net Weight (Kilograms)  
Gross Weight (Kilograms & Pounds Avoirdupois)  
Government Contract Number  
Specification Number and Date

Shipping - Identifying documents shall accompany each box during shipment.

The palletized boxes shall be loaded, braced, and blocked in the carrier's conveyance in compliance with applicable rules and regulations set forth in the carrier's classification and other tariffs.

For rail shipments, the applicable rules and regulations published by the Association of American Railroads in Pamphlet No. 4 and 14, and Circular No. 42, latest revisions, shall be followed.

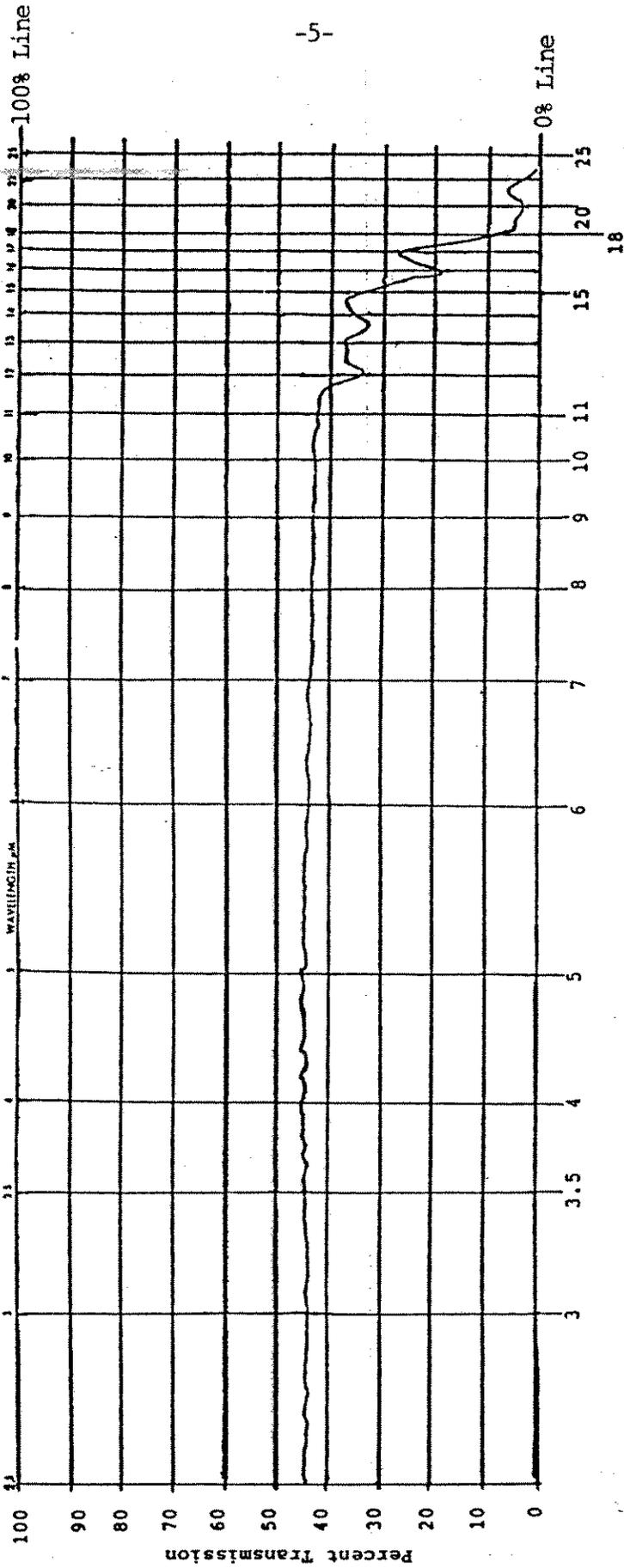


Figure 1  
Transmission Through 10 mm Sample