SAE Aerospace
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AEROSPACE MATERIAL SPECIFICATION

SAE AMS 2465 | REV. C

Issued 1963-07
Revised 1983-10
Noncurrent 2005-02
Reaf. Nonc. 2011-10

Superseding AMS 2465B

Disilicide Diffusion Coating of Molybdenum and Molybdenum Alloys Pack Cementation Method

NONCURRENT NOTICE

This specification has been declared “NONCURRENT” by the Aerospace Materials Division, SAE, as of February, 2005. It is recommended, therefore, that this specification not be specified for new designs. The process is no longer available and there are no suggested substitutes for this document.

“NONCURRENT” refers to those specifications which have previously been widely used and which may be required on some existing designs in the future. The Aerospace Materials Division, however, does not recommend these specifications for future use in new designs.

“NONCURRENT” specifications are available from SAE upon request.

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1. SCOPE:

1.1 Purpose: This specification covers the procedure for applying a disilicide diffusion coating to molybdenum and molybdenum alloy parts by the pack cementation method and the properties of the coating so deposited.

1.2 Application: Primarily to provide protection against oxidation above 1100°F (595°C) and for operation in oxidizing atmospheres to approximately 3000°F (1650°C) for limited duration.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA.15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103*

ASTM C664 - Thickness of Diffusion Coating

2.3 U.S. Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Military Standards:

MIL-STD-794 - Parts and Equipment, Procedures for Packaging and Packing of

3. TECHNICAL REQUIREMENTS:

3.1 Equipment:

3.1.1 Retort: A specially constructed retort designed to withstand operating temperatures up to 2100°F (1150°C).

3.1.2 Coating Material: Shall be a siliconizing compound composed of inert filler, silicon, and a suitable halide salt.

3.2 Preparation:

3.2.1 Machining, welding, brazing, forming, and heat treating shall be completed before parts are coated.

3.2.2 Corners and edges shall be smoothly and uniformly rounded; corner radii shall be not less than 0.125 in. (3 mm) and radii on edges (including holes and cut outs) shall be not less than t/2 where "t" is the thickness of the material, but in no case shall be less than 0.005 in. (0.12 mm).

3.2.3 Parts to be coated shall be cleaned free of grit, dirt, oil, grease, and other foreign materials by a method which will produce results equivalent to the following: wet abrasive blast, wash in a detergent solution, rinse in distilled water, and dry with warm air blast (See 8.2.1).

3.2.4 Immediately before coating, parts shall be degreased with a volatile solvent.

3.3 Procedure:

3.3.1 The time and temperature used for application of the coating shall be adequate for the coating to comply with the requirements specified on the drawing but without causing recrystallization of the basis metal.

3.3.2 Components of riveted assemblies shall be coated prior to assembly and shall be recoated by the same procedure after assembly.

3.3.3 The parts to be coated shall be packed in a retort with the coating compound of 3.1.2 (See 8.2.2). An atmosphere control compound may also be used. Alloying materials may be added, when desired, to improve the characteristics of the coating. The retort shall be sealed and heated to a temperature between 1750°F (950°C) and 2100°F (1150°C), held at the selected temperature within ±25°F (±15°C) for not less than 3 hr, and cooled. Breaking of the seal and removal of the parts from the pack shall not be performed until the pack has cooled to 500°F (260°C) or lower.

3.3.4 Parts of extremely thin section or having other features which may require special handling shall be treated as agreed upon by purchaser and vendor (See 8.2.3).

3.4 Properties: Coating shall conform to the following requirements:

3.4.1 Thickness: The total coating thickness shall be 0.0015 - 0.0025 in. (38 - 62 µm), determined in accordance with ASTM C664, Method B.

3.4.2 Oxidation Resistance: Coated parts shall be placed in a static-air atmosphere furnace previously heated to 2200°F ± 25 (12OO°C ± 15). After the parts have reached 2200°F ± 25 (1200°C ± 15), visual observation shall be made at least five times at intervals of two minutes. The parts shall be removed after a total time at 2200°F ± 25 (1200°C ± 15) of 10 minutes. If molybdenum oxide smoke is observed at any time during the test, the part shall be removed from the furnace. Observation of smoke during the test or after removal from the furnace upon completion of the.10-min. cycle shall be cause for rejection of the offending part.

3.5 Quality: The coating shall be uniform, adherent to basis metal, and free
Ø from defects detrimental to performance of the coating and shall cover all surfaces of the part.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The Vendor of coated parts shall supply all
Ø samples for vendor's tests and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.5. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the coating conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to requirements for edge
Ø and corner radii (3.2.2) and coating thickness (3.4.1) are classified as acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Tests to determine conformance to requirements for
Ø freedom from recrystallization (3.3.1) and oxidation resistance (3.4.2) are classified as periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.2.3 Preproduction Tests: Tests to determine conformance to all technical
Ø requirements of this specification are classified as preproduction tests and shall be performed prior to or on the initial shipment of coated parts to a purchaser, when a change in material or processing, or both, requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.2.3.1 For direct U.S. Military procurement, substantiating test data and, when
Ø requested, preproduction test material shall be submitted to the cognizant agency as directed by the procuring activity, the contracting officer, or the request for procurement.

4.3 Sampling: Shall be not less than the following; a lot shall be all parts of Ø the same part number coated in the same retort at the same time and presented for vendor's inspection at one time:

4.3.1 Edge and Corner Radii: One part from each lot.

4.3.2 Thickness: Two test samples per lot, not less than 1 x 1.5 in. (25 x 40 mm), from the same material as the basis metal and preferably of the same thickness and the same minimum radii and coated with the parts. one of the samples shall be furnished to purchaser for measurement of coating thickness.

4.3.3 Oxidation Resistance and Recrystallization: As agreed upon by purchaser and vendor.

4.4 Approval:

4.4.1 Coated parts shall be approved by purchaser before parts for production use Ø are supplied, unless such approval be waived by purchaser. Results of tests on production parts shall be equivalent to those on the approved sample parts.

4.4.2 Vendor shall use materials, manufacturing procedures, processes, and methods of inspection on production parts which are essentially the same as those used on the approved sample parts. If necessary to make any change in type of equipment, in established composition limits, or in processing parameters, vendor shall submit for reapproval a statement of the proposed changes in material or processing, or both, and, when requested, sample test specimens, coated parts, or both. Production parts coated by the revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Reports: The vendor of coated parts shall furnish with each shipment three copies of a report showing the purchase order number, AMS 2465B, part and coating material specification numbers and their revision letters, if any, contractor or other direct supplier of part and coating materials, part number, and quantity. When coating material is produced or purchased by the coated parts vendor, that vendor shall inspect each lot of material to determine conformance to the applicable material specification and shall include in the report either a statement that the materials conform or copies of laboratory reports showing the results of tests to determine conformance. This report shall also include the results of tests to determine that the coating conforms to the acceptance test requirements of this specification.