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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 2406J

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Superseding AMS 2406H

Plating, Chromium Hard Deposit

1. SCOPE:

1.1 Purpose:

This specification covers the engineering requirements for electrodeposited hard chromium plate and processing requirements.

1.2 Application:

This plating has been used typically on parts for increasing abrasion resistance, increasing tool and die life, maintaining accuracy of gauges, and reconditioning worn or undersized parts, but usage is not limited to such applications.

1.3 Safety-Hazardous Materials:

While the materials, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards which may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

2. APPLICABLE DOCUMENTS:

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been canceled and no superseding document has been specified, the last published issue of that document shall apply.

QUESTIONS REGARDING THIS DOCUMENT: (724) 772-7161 FAX: (724) 776-0243
TO PLACE A DOCUMENT ORDER: (724) 776-4970 FAX: (724) 776-0790
SAE WEB ADDRESS: http://www.sae.org

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2759/9 Hydrogen Embrittlement Relief (Baking) of Steel

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM B 253 Preparation of Aluminum Alloys for Electroplating
ASTM B 487 Measurement of Metal and Oxide Coating Thicknesses by Microscopical Examination of a Cross Section
ASTM B 499 Measurement of Coating Thicknesses by the Magnetic Method: Nonmagnetic Coatings on Magnetic Basis Metals
ASTM B 504 Measurement of Thickness of Metallic Coatings by the Coulometric Method
ASTM B 568 Measurement of Coating Thickness by X-Ray Spectrometry
ASTM B 571 Qualitative Adhesion of Metallic Coatings
ASTM B 578 Microhardness of Electroplated Coatings
ASTM F 519 Mechanical Hydrogen Embrittlement Evaluation of Plating Processes and Service Environments

3. TECHNICAL REQUIREMENTS:

3.1 Preparation::

3.1.1 Steel parts having hardness over 40 HRC and which have been ground, machined, cold formed, or cold straightened after heat treatment shall be cleaned to remove surface contamination and stress-relieved before preparation for plating. Unless otherwise specified, the stress relief shall be not less than 275 °F (135 °C) for five hours for parts with hardness of 55 HRC or greater and not less than 375 °F (191 °C) for four hours for other parts.

3.1.2 Parts shall have clean surfaces, free from water break, prior to immersion in the plating solution.

3.1.3 Electrical contact points shall be as follows: for parts which are to be plated all over, location shall be acceptable to purchaser; for parts which are not to be plated all over, location shall be in areas where plating is optional.

3.2 Procedure:

3.2.1 Deposition: The chromium shall be deposited directly on the basis metal without a coating of other metal underneath, except in the case of parts made of maraging steels, corrosion-resistant steels, or aluminum alloys, on which a preliminary deposit of nickel or other suitable metal 0.0002 inch (5 µm) thickness maximum is permissible. Zincate immersion coating in accordance with ASTM B 253 may be used on aluminum alloys.

3.3 Hydrogen Embrittlement Relief:

Treatment of steel parts shall be in accordance with AMS 2759/9.

3.4 Properties:

The deposit shall conform to the following requirements:

3.4.1 Thickness: Shall be as specified on the part drawing, determined in accordance with ASTM B 487, ASTM B 499, ASTM B 504, ASTM B 568, or other method acceptable to purchaser.

3.4.1.1 The plate shall be substantially uniform in thickness on significant surfaces except that build-up at exterior corners or edges will be permitted provided finished drawing dimensions are met.

3.4.1.2 All surfaces of the part, except those which cannot be touched by a sphere 0.75 inch (19 mm) in diameter, shall be plated to the thickness specified. Unless otherwise specified, these surfaces, such as holes, recesses, threads, and other areas where a controlled deposit cannot be obtained under normal plating conditions, may be under specified limits provided they show coverage.

3.4.2 Hardness: Shall be not lower than 700 HV, or equivalent, determined in accordance with ASTM B 578 except that a Vicker's indenter and 100 gram load shall be used.

3.4.3 Adhesion: The deposited coating shall be tightly adherent to the substrate, determined in accordance with ASTM B 571.

3.4.4 Hydrogen Embrittlement: The chromium plating process, after baking, shall not cause hydrogen embrittlement in steel parts 40 HRC and over, determined in accordance with the requirement of ASTM F 519 (See 4.3.3.2).

3.5 Quality:

Plating, as received by purchaser, shall be firmly bonded to the basis metal, and shall be smooth and uniform in appearance and, except as noted in 3.5.1, shall be bright, free from frosty areas, pinholes, nodules, blisters and other imperfections detrimental to performance of the deposit. Visual inspection may be aided by not greater than 5X magnification.

3.5.1 Pinholes and other imperfections which can be shown to be the result of failure of the deposit to bridge or fill imperfections, such as porosity, in the surface of the basis metal are acceptable.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The processor shall supply all specimens for processor's tests and shall be responsible for performance of all required tests. Where parts are to be tested, such parts shall be supplied by purchaser. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that processing conforms to the specified requirements.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Thickness (3.4.1), adhesion (3.4.3), and quality (3.5) are acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Hardness (3.4.2), embrittlement (3.4.4), and tests of cleaning and plating solutions (See 8.5) to ensure that deposited metal will conform to specified requirements are periodic tests and shall be performed at a frequency selected by the processing vendor unless frequency of testing is specified by purchaser.

4.2.3 Preproduction Tests: All technical requirements are preproduction tests and shall be performed when preproduction tests are specified on the initial shipment of a plated part to a purchaser, when a change in material and/or processing requires reapproval by the cognizant engineering organization (See 4.4.2), and when purchaser deems confirmatory testing to be required.

4.3 Sampling and Testing:

Shall be as follows; a lot shall be all parts of the same part number processed in a continuous operation, to the same thickness range, in the same set of solutions, in not longer than 24 consecutive hours, and presented for processor's inspection at one time.

4.3.1 For Acceptance Tests: Test samples shall be selected randomly from all parts in the lot. Unless purchaser supplies a sampling plan, the minimum number of samples shall be as shown in Table 1.

TABLE 1 - Sampling for Acceptance Testing

Number of Parts in Lot	Quality	Thickness and Adhesion
Up to 7	all	3
8 to 15	7	4
16 to 40	10	4
41 to 110	15	5
111 to 300	25	6
301 to 500	35	7
501 to 700	50	8
701 to 1200	75	10
Over 1200	125	15

4.3.2 For Periodic and Preproduction Tests: Sample quantity shall be at discretion of the processor unless otherwise specified by purchaser.

4.3.3 Nondestructive test methods shall be selected wherever practical. Except as noted, actual parts shall be selected as samples for tests.

4.3.3.1 When plated parts are of such configuration or size as to be not readily adaptable to the specified tests or when nondestructive testing is not practical on actual parts, or it is not economically acceptable to perform destructive tests on actual parts, separate test specimens of the same generic class of alloy as the parts represented, cleaned, plated, and post-treated with the parts represented may be used.

4.3.3.2 Hydrogen embrittlement test specimens shall conform to ASTM F 519 Type 1 using notched round bars stressed in tension under constant load. For test purposes, plating thickness shall be 0.0002 inch ± 0.002 (51 µm ± 5), measured on the smooth section of the specimen, but with visual evidence of plating in the root of the notch.

4.4 Approval:

4.4.1 The process and control procedures, a preproduction sample part, or both, whichever is specified, shall be approved by the cognizant engineering organization before production parts are supplied.

4.4.2 The processor of plated parts shall make no significant change in bath type, plating conditions, or control factors from those on which approval was based, unless the change is approved by the cognizant engineering organization. A significant change is one which, in the judgement of the cognizant engineering organization, would affect properties or performance of the parts.

4.4.3 Control factors shall include, but not be limited to, the following:

Surface preparation and cleaning procedures
Surface activation procedure(s)
Plating bath composition and composition control limits
Plating bath temperature limits and controls
Current or voltage limits and controls
Method for testing plating thickness
Method for testing adhesion
Stripping procedure, if used
Periodic test plan

4.5 Reports:

The processor shall furnish with each shipment a report stating that the parts have been processed and tested in conformance with specified requirements and that they conform to the acceptance test requirements. This report shall include the results of the acceptance tests, purchase order number, lot number, AMS 2406J, part number, and quantity.

4.6 Resampling and Retesting:

4.6.1 If the results of any acceptance test fail to meet specified requirements, the parts in that lot may be stripped by a method acceptable to purchaser which does not roughen, pit, or embrittle the basis metal, pretreated, plated, and post treated as defined herein and tested. Alternatively, all parts in the lot may be inspected for the nonconforming attribute, and the nonconforming parts may be stripped by a method acceptable to purchaser that does not pit, roughen, or embrittle the basis metal, pretreated, plated, post treated as defined herein, and retested.

4.6.2 If the results of any periodic test fail to meet specified requirements, the process is nonconforming. No additional parts shall be plated until the process is corrected and specimens are plated and retested. Results of all tests shall be recorded and, when requested, reported. Purchaser shall be notified of all parts plated since the last acceptable test.

5. PREPARATION FOR DELIVERY:

5.1 Packaging:

5.1.1 Plated parts shall be handled and packaged to ensure that the required physical characteristics and properties of the plating and parts are preserved.

5.1.2 Packages of plated parts shall be prepared for shipment in accordance with commercial practice and in compliance with applicable rules and regulations pertaining to the handling, packaging, and transportation of the parts to ensure carrier acceptance and safe delivery.

6. ACKNOWLEDGMENT:

Processor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.

7. REJECTIONS:

Parts on which the plating does not conform to this specification, or to modifications authorized by purchaser, will be subject to rejection.

8. NOTES:

8.1 A change bar (**l**) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this specification. An (R) symbol to the left of the document title indicates a complete revision of the specification, including technical revisions. Change bars and (R) are not used in original publications, nor in specifications that contain editorial changes only.