



AEROSPACE MATERIAL SPECIFICATION

Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AMS 2435B

Superseding AMS 2435A

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DETONATION PROCESS Tungsten Carbide - 9% Cobalt

1. SCOPE:

- 1.1 Purpose: This specification covers the engineering requirements for applying tungsten carbide/cobalt coatings to metal parts by the detonation process and the properties of such coatings.
- 1.2 Application: Primarily to provide a hard, wear-resistant surface on metal parts which do not operate higher than 1000° F (540° C). This coating is not recommended for surfaces with deep vee-shaped grooves, blind cavities, narrow holes or sharp corners, or where deformation of the basis metal may be expected.

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 Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specification:

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 C633 - Adhesion or Cohesive Strength of Flame Sprayed Coatings
ASTM E384 - Microhardness of Materials

- 2.3 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: A specially constructed machine in which the particles of coating material are fed into the tube of a gun, suspended in a mixture of oxygen, acetylene, and nitrogen, and detonated, heating the particles to plasticity and hurling them at high velocity out of the gun barrel onto the part.

- 3.2 Coating Material: Shall consist of approximately 91% tungsten carbide and 9% cobalt.

3.3 Preparation:

- 3.3.1 Surfaces to be coated shall be machined to allow for the finished thickness of the coating.

SAE Technical Board rules provide that: "All technical reports, including standards approved and practices recommended, are advisory only. Their use by anyone engaged in industry or trade shall be at the user's discretion. There is no agreement to adhere to any SAE standard or recommended practice, and no commitment to conform to or be guided by any technical report. In formulating and approving technical reports, the Board and its committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against liability for infringement of patents."

- Ø 3.3.2 Parts requiring heat treatment or shot peening shall be so processed prior to coating.
- 3.3.3 Parts shall be cleaned to remove water, oil, grease, dirt, scale, paint, and other foreign materials detrimental to adhesion of the coating.
- 3.3.4 Parts shall be suitably masked to protect surfaces not required to be coated.
- 3.3.5 Surfaces to be coated shall be grit blasted to produce a uniform matte finish sufficient to provide
Ø good adhesion of the coating.
- 3.4 Procedure:
- 3.4.1 Coating: The coating material shall be deposited onto the designated surfaces to a sufficient
Ø thickness to permit finishing to specified dimensions. The temperature of the parts during deposition shall be controlled so as not to exceed 300° F (150° C).
- 3.4.2 Surface Finishing: Procedures for grinding and lapping shall be as agreed upon by purchaser and vendor.
- 3.5 Properties: The coating on parts and representative test specimens shall conform to the following
Ø requirements; except for the test of 3.5.1.1, test specimens shall be steel cubes nominally 3/8 in. (9.5 mm) on a side coated on one face to thickness of 0.008 - 0.010 in. (0.20 - 0.25 mm):
- 3.5.1 Test Specimens:
- 3.5.1.1 Bond Strength: Shall be not lower than 10,000 psi (6.9 MPa), determined in accordance with
Ø ASTM C633 except that the coating thickness shall be 0.008 - 0.010 in. (0.20 - 0.25 mm).
- 3.5.1.2 Hardness: Shall be 1150 - 1400 HV300, determined in accordance with ASTM E384 as the
Ø average of not less than 10 microhardness readings taken on a cross-section of the specimen.
- 3.5.1.3 Inclusions and Apparent Porosity: Foreign particle inclusions shall be not more than 1.5%
Ø of the coating cross-section, determined by microscopic examination at 200X magnification.
- Ø 3.5.1.4 Cracks and Interface Bond Separation: Shall be absent.
- 3.5.2 Finished Parts:
- 3.5.2.1 Hardness: Shall be 1150 - 1400 HV300, determined in accordance with ASTM E384 as the
Ø average of not less than 10 microhardness readings taken on a cross-section of the part.
- 3.5.2.2 Inclusions and Apparent Porosity: Shall conform to acceptance standards specified by the
Ø purchaser, determined by procedures agreed upon by purchaser and vendor.
- 3.6 Quality: The coating shall be adherent to the basis metal and shall have a uniform, continuous surface free from spalling, chipping, flaking, and other objectionable imperfections. Standards for acceptance shall be as agreed upon by purchaser and vendor.
- 3.7 Tolerances: A tolerance of -0 and +0.125 in. (+3.18 mm) is allowed on the boundaries of areas
Ø designated to be coated, unless otherwise specified.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of coated parts shall supply all samples 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 perform such confirmatory testing as he deems 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 thickness (3.4.1) and properties of test specimens (3.5.1) are classified as acceptance tests and shall be performed to represent each lot.

4.2.2 Periodic Tests: Tests to determine conformance to requirements for composition of coating material (3.2) and properties of coated parts (3.5.2) 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 requirements of this specification are classified as preproduction tests and shall be performed on the initial shipment of coated parts to a purchaser, when a change in processing requires reapproval, or when purchaser deems confirmatory testing is required.

4.2.3.1 For direct U. S. Military procurement, substantiating test data and, when 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 essentially the same configuration coated in a continuous operation to the same thickness with powder from the same batch and presented for vendor's inspection at one time:

4.3.1 Acceptance Tests: Two sets of specimens, one coated at the beginning and one coated at the end of each lot.

4.3.2 Periodic Tests and Preproduction Tests: As agreed upon by purchaser and vendor.

4.4 Approval:

4.4.1 Parts coated in accordance with this specification shall be approved by purchaser before parts for production are supplied, unless such approval be waived. Results of tests on production parts shall be essentially equivalent to those on the approved sample parts.

4.4.2 Vendor shall use manufacturing procedures, processes, and methods of inspection on production parts which are essentially the same as those used on the approved sample parts. If any change is necessary in type of equipment, in established composition limits, or in processing parameters, vendor shall submit for reapproval a statement of the proposed changes in processing 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, part and coating material specifications and their revision letters, if any, contractor or other direct supplier of part and coating materials, part number, and quantity. When material for making parts and/or the coating material is produced or purchased by the coated parts vendor, that vendor shall inspect each lot of material and shall include in the report a statement that the materials conform or shall include 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.