SAE Aerospace
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AEROSPACE STANDARD

SAE AS7108/2

REV. A

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Superseded by AS7108B

National Aerospace and Defense Contractors Accreditation Program Requirements for Etch Processes (Macrostructure, Nital, Temper, Blue Etch Anodize)

CANCELLATION NOTICE

This document has been declared "CANCELLED" as of April 2005 and has been superseded by AS7108B. By this action, this document will remain listed in the Numerical Section of the Aerospace Standards Index noting that it is superseded by AS7108B.

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1. SCOPE:

This Aerospace Standard (AS) establishes the requirements for suppliers for Etching Processes to be accredited by the National Aerospace and Defense Contractors Accreditation Program (NADCAP). These requirements may be supplemented by additional requirements specified by NADCAP Chemical Processing Task Group. Using the audit checklist (AC7108/2) will ensure that accredited Chemical Processing suppliers meet all of the requirements in this standard and all applicable supplementary standards.

2. REFERENCES:

2.1 Definition of Terms:

CONTROL LIMITS: Calculated operating limits resulting from statistical analysis of solution constituent data.

DEIONIZED WATER: 50,000 ohm.cm resistivity minimum.

ETCH INSPECTION: The process may also be known by other terms, such as temper etch, acid etch, or nital etch. These are all terms for inspection processes for detection of surface anomalies caused by either abusive machining or grinding of parts or improper macrostructure of alloy.

PROCEDURE: A detailed “how to”, step-by-step revision controlled document used to enforce or implement company policy.

POLICY: A written company philosophy on how something should be done in very broad generic terms. The existence of a procedure shall satisfy the requirements for a policy.

% RIPPLE: Root Mean Square voltage divided by the DC voltage x 100.

SHOP TARGET LIMITS: The processor-set operating limits (for solution control parameters) that aid in not exceeding the manufacturer’s recommended, or customer specification limits.

TECHNICAL BULLETIN LIMITS: The specification or manufacturer-set limits beyond which the process must be shut down.

3. JOB DOCUMENTATION:

3.1 Shop paper/traveler, which accompanies each job, shall contain as a minimum the following information:

a. A step for each process performed with applicable internal process/or inspection procedure numbers Including as applicable:

1) Incoming inspection

2) Pre-process cleaning method(s)

3) Fixturing, racking

4) Masking

5) Etch

6) Post-process cleaning methods

7) Post-process thermal treatment

8) In-process and final tests and inspections, including disposition

9) Rework

b. Specific process parameters which are controlled by the operator are recorded for the first batch of parts processed, including:

1) Masking material used

2) Temperature, time, voltage (as applicable) for anodize, etching

3) Pre/post thermal treatments, racking, and fixturing

4. PROCESS EQUIPMENT CONTROL AND MAINTENANCE:

4.1 General:

4.1.1 Tanks shall be labeled to include identification number, contents, and temperature ranges.

4.1.2 The air supply shall be clean, dry, and filtered.

4.2 Maintenance Procedures:

4.2.1 Tanks and/or other equipment shall be equipped with sufficient filtration as required to remove contamination.

4.2.2 Records shall indicate that maintenance has been performed in accordance with a procedure and to a defined frequency.

4.2.3 Maintenance procedures shall be written with preventative maintenance as a goal and based on prior maintenance records.

4.3 Process Line Equipment:

4.3.1 Tanks and work surfaces shall be maintained sufficiently free of corrosion and chemical spillage.

4.3.2 Immersion and spray rinse tanks shall be clean, clear, free-running or monitored for contamination levels, and situated in a sequence to prevent cross contamination of process tanks and to assure adequate neutralization and/or removal of process chemicals.

4.3.2.1 If processing titanium, deionized water shall be used for final rinsing and the total halogen (i.e. total bacterial chlorine and chloride ion) level monitored/controlled as required by customer specifications.

4.3.3 Lifting systems (hoists) shall be labeled as to capacity and shall be available to quickly move hardware from one tank to another.

4.3.4 Process and rinse tanks shall be situated such that hardware can be maintained wet, from final cleaning throughout the process to final rinse, without interruption.

4.3.5 Parts shall be rapidly transferred from etch to rinse tanks so as to preclude local overetching.

4.3.6 Parts shall be positioned during etching so as to minimize/preclude air or evolving gas entrapment in pockets or other recessed areas.

4.3.7 Tanks with temperature range requirements shall be equipped with thermostatic controls.

4.3.8 Tanks shall have sufficient volume and dimensions to contain hardware during processing and to assure sufficient coverage of parts.

4.3.9 Tanks that require uniformity of temperature and solution concentration shall be agitated.

4.3.10 Fixtures shall be designed to adequately carry the weight of the hardware.

4.3.11 Fixtures, workbars, electrical connections, and hard masking shall be sufficiently free of corrosion and physical damage while in use.

4.3.12 Fixtures and masking shall be designed to prevent air or solution entrapment on parts to be processed.

4.3.13 Fixturing and racking shall be designed adequately so that, when hardware is positioned for rinsing, there is adequate process solution neutralization and removal and it shall minimize process solution and rinse water dragout and cross-contamination of process tanks.

4.3.14 Fixturing and rack design, the arrangement of workbars and cathode(s) are such that electrical contacts are solid, but preclude potential pressure damage or electrical arcing to the hardware.

4.3.15 Tanks for blue etch anodizing shall be equipped with cathodes that can be reconfigured as needed or auxiliary electrodes used for processing hardware with variable geometric configuration or for variable lot sizes to promote uniform oxide buildup.

4.3.16 There shall be procedures in place to ensure that the part is not introduced, moved, or removed from the etching process when current is applied (power on) unless otherwise specified.

4.3.17 Electrode type and placement shall be specified in customer required frozen planning procedures.

4.3.18 Hoists and other lifting equipment shall be electrically insulated from the work.

4.4 Operator Qualifications:

4.4.1 There shall be an operator/inspector training, qualifying, examining, and certifying program in place.

4.4.2 Procedures shall require periodic evaluations to ensure that approved personnel maintain proficiency in their assigned tasks.

4.4.3 Records shall indicate that evaluations are conducted and the results reviewed with employees.

4.4.4 The results of evaluations shall be used in a program of continuous improvement of personnel.

4.4.5 Records shall indicate that training is scheduled and attended in accordance with the procedure.

4.4.6 Documented definitions of the personnel functions shall exist that describe special skill categories that require training and qualification including the following:

a. Processing personnel

b. Testing / Inspection Personnel

c. Data review personnel

d. Specimen preparation personnel

4.4.7 Testing and data review personnel shall be qualified through at least one of the following:

a. Training by personnel with technical degree and/or related experience

b. Initial technical examination

c. Periodic technical examination

4.4.8 The training program shall be structured to assure inspection/interpretation is done by qualified personnel.

4.4.9 The training program shall consist of a physical, written, and practical test.

4.4.10 The physical test shall include a vision test, administered by medically qualified personnel, with a requirement of reading Ortho-Rater or Jaeger #2 letters, at 12 in (300 mm) in at least one eye.

4.4.11 The operator/inspector shall be requalified on a maximum cycle of 3 years.

4.4.12 If an operator/inspector fails testing qualifications, there shall be documentation of suitable corrective action and additional training conducted before re-examination is allowed.

4.4.13 Records for all qualified personnel shall be maintained and shall include date of qualification, results of physical, written, and practical examinations.

4.5 Cleaning Procedures:

4.5.1 General:

4.5.2 Procedures shall provide for removal of grease, oils, dirt and other contaminants, and shall provide for adequate adhesion of masking.

4.5.3 Cleaning procedures shall be compatible with part alloys (basis metals) being processed (i.e., - Ti must have special cleaning setups).

4.5.4 Hardware coupons shall be processed as required through the cleaning procedures with the hardware.

4.5.5 Parts shall be suitably protected against re-contamination prior to subsequent processing.

4.6 Mechanical Cleaning:

4.6.1 Procedures and controls shall be in place to assure proper media (grit vs. glass beads) and grit particle size distribution is maintained and cross contamination of alloys during mechanical cleaning (e.g., aluminum and iron based alloys) is minimized.

4.6.2 When abrasive blast techniques are used, off-set distances, times, pressures, and media shall be recorded.

4.6.3 Roughness standards shall be used to maintain surface finish, as required by customer.

4.6.4 Hardware shall be visually inspected and documented to verify corrosion, oxides, scale, and abrasive media have been removed.

4.7 Chemical Cleaning Prior to Etching:

4.7.1 Cathodic cleaning shall be prohibited with high strength steels 180 KSI and greater.

4.7.2 All hardware shall be maintained wet and a water break free surface shall be observed; after the cleaning cycle.

4.8 Masking:

4.8.1 Planning shall specify areas to be masked including identity marking and serialization when marking could be affected.

4.8.2 Masking materials shall be generically specified on the shop paper.

4.8.3 Masking materials shall be compatible with hardware and process conditions.

4.8.4 Masking shall be designed to assure part area to be processed (selective etching/anodizing) is exposed and all other areas precluded as required by the customer.

4.8.5 Adhesives, masking material, markings, and residual chemicals shall be removed after processing and before further thermal processing or shipment.

4.8.6 Parts shall be suitably masked or protected to prevent attack of surfaces of the hardware that are not to be subsequently chemically processed.

4.8.7 Procedures shall be in place for masking prior to cleaning, for visual inspection of adequate masking before and after cleaning, and for remasking when damaged during mechanical cleaning.

4.9 Power Supplies:

4.9.1 Power supplies shall be equipped with calibrated ammeters and voltmeters.

4.9.2 Each tank shall have dedicated meters, with sufficient resolution, that are capable of reflecting actual power at the tank.

4.9.3 The resolution of the power meters shall be sufficient for the voltage and amperage range specified in the planning.

4.9.4 Rectifiers shall be uniquely identified to the tank which they service, or if not, each tank shall have an individual rheostat.

4.9.5 If a power failure occurs, there shall be a mechanism that requires the operator to physically restart the power supply.

4.9.6 For blue etch anodize, the power supply ripple level shall be controlled at 6% max. at 30V, and no load.

4.9.7 For blue etch anodize, power supplies shall be capable of increasing voltage from 0-30V in 1-3 seconds.

4.9.8 For blue etch anodize, power supplies shall be equipped with a ramp control or a resistor with automatic cut-out to minimize arcing.

4.10 Timers:

4.10.1 Timers shall be available, suitable to the purpose, calibrated to traceable standards, and visible from the tanks.

4.11 Electrical Contacts:

4.11.1 Fixtures shall be designed to preclude the possibility of electrical contact (short circuit) between the hardware and the opposite charged electrode.

4.11.2 Contacts shall be of sufficient area to carry the required current load without overheating/deteriorating. (i.e., no signs of scorch marks, irregularities on contact surface, etc.)

4.11.3 If required by the customer, contact locations shall be in the specified area.

4.11.4 For blue etch anodize, contact locations shall be precluded from hardware bolt holes unless authorized by the customer.

4.11.5 Fixture contact locations shall be cleaned periodically to ensure that corrosion, dirt, and grease are removed.

4.12 Post Process Corrosion Protection:

4.12.1 Procedures shall ensure handling, packaging and corrosion protection of parts.

4.13 Stress Relief/Hydrogen Embrittlement:

4.13.1 There shall be a procedure for temperature uniformity tests or it shall be performed by an outside source

4.13.2 There shall be a procedure which specifies the following at a minimum:

a. Test frequency.

b. Test temperature(s) and range(s).

c. This range shall cover all baking operations.

d. Placement of thermocouples.

4.13.3 Uniformity surveys shall be performed on baking ovens at least semi-annually.

4.13.4 Temperature uniformity surveys shall conform to the uniformity requirements of AMS 2750 or customer requirements.

4.13.5 System accuracy tests (i.e., probe checks) shall be performed at least monthly or in accordance with customer requirements.

4.13.6 The tests shall demonstrate that the system accuracy is ± 5°F.

4.13.7 Instruments on ovens shall be calibrated semi-annually and traceable to NIST.

4.13.8 The oven (furnace) that is being used to perform stress relief shall have a integral continuous temperature recorder available to collect the temperature data.

4.14 Etch Inspection Processes:

4.14.1 Standards or known defects shall be processed periodically to assure process capability.

4.14.2 The inspection area shall be sufficiently lighted to achieve 200 ft candles minimum at surface height that the visual inspection is being conducted.

4.14.3 A white light meter shall be available in the inspection area, or periodic calibration data shall demonstrate that the area is acceptably lighted.

4.15 Etch Rate Determinations:

4.15.1 Stock removal (etching) rates shall be determined prior to processing hardware and verified at the end of the workday.

4.15.2 Stock removal (etch rate) panels, made from the same (or similar) alloy and in the same processed condition as the hardware, shall be controlled for maximum number of uses.

4.15.3 Stock loss shall be determined by weight/dimensional change.

4.15.4 There shall be assurance that inspection, measuring, and test equipment is capable of the necessary accuracy, precision, and operating range.

5. TEST AND INSPECTION:

5.1 Process Control Laboratory Procedures (Solution Analysis):

5.1.1 There shall be assigned responsibilities for review and approval of test results, authorization of retests, calculation of process solution additions and corrections, and the preparation and approval of test procedures.

5.1.2 Those responsibilities shall be performed by a degreed chemist or equivalent qualified individual, or by a technician supervised by such an individual, and their job responsibilities, job specifications and qualifications shall be documented, or an outside laboratory shall be employed.