American Gear Manufacturers Association

Technical Resources

ISO 14104:1995, IDT
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American National Standard

Gears – Surface Temper Etch Inspection After Grinding

ANSI/AGMA 2007-C00

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ANSI/AGMA 2007-C00
ISO 14104:1995, IDT
[Revision of ANSI/AGMA 2007-B92]

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Approved November 2, 2000

ABSTRACT

Surface Temper Etch Inspection After Grinding explains the materials and procedures necessary to determine, evaluate, and describe localized overheating on ground surfaces. A system to describe and classify the indications produced during this inspection is included. However, specific acceptance or rejection criteria are not contained.

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Foreword

[The foreword, footnotes and annexes, if any, in this document are provided for informational purposes only and are not to be construed as a part of ANSI/AGMA Standard 2007–C00, *Gears – Surface Temper Etch Inspection After Grinding.*]

AGMA 230.01 was written to standardize a process of surface temper inspection.

An industry wide survey conducted by the committee indicated a wide variation in solution strengths and times used, which gave rise to that standard. The safety and environmental precautions included therein were a caution for those not familiar with the storage, handling, use and disposal of concentrated acids, alkalis and solvents. Those precautions, however, did not supersede the latest OSHA, EPA, and DOT requirements. The solutions and times stated therein work and were acceptable to the greatest number of users.

The safety precautions no doubt are superfluous to many. However, due to the difference of this inspection from ordinary shop practice, it is felt that some caution should be directed to those manufacturers without benefit of personnel trained in the proper use and handling of these materials.

The first committee draft of AGMA 230.01 was prepared in September, 1963. It was approved by the Surface Temper Inspection Process Task Committee as of September, 1964. AGMA 230.01 was approved by the AGMA membership as of April 13, 1967.

The revision of AGMA 230.01, designated ANSI/AGMA 2007–B92, was begun in May 1989. It was renamed *Surface Temper Etch Inspection After Grinding*, for better definition, the contents reorganized, and obsolete procedures deleted. Type 1 (hot bleach) Etching was published in AGMA 230.01 as table 2A in an appendix. This table was not included in the revision; the use of Type 2 or Type 3 Etching was recommended instead.

Another specification covering temper etch inspection is MIL–STD–867A, *Temper Etch Inspection.*

ANSI/AGMA 2007–B92 was adopted as an International Standard (ISO 14104:1995) through ISO's "fast track procedures", by Technical Committee TC 60 Gears.

This ANSI standard, designated ANSI/AGMA 2007–C00, is an identical adoption of ISO 14104:1995. The differences between it and ANSI/AGMA 2007–B92 are:

- The Scope is modified to delete the statement that the standard applies to steel parts "40 HRC or greater". In addition, the stipulation that the procedure is to be performed after grinding and before additional finishing operations is made.
- Clause 2 in ANSI/AGMA 2007–B92, "Requests, approval and certification" is located in clause 10, "Specifications and documentation" in this standard. The requirement "When this standard is referenced, materials, equipment and processes, as listed herein, shall be used" is deleted.
- In the last paragraph of sub–clause 4.2, "Etching", a recommended time for elevated temperature bake is indicated.
- In table 3, "Type 3 etching", the recommended time for step 4, nitric acid etch, in alcohol, is 1.5 to 3.5 minutes, instead of 1.5 to 2.5 minutes.
- Sub–clause 5.1 contains an additional paragraph, recommending that users of the standard set their own reference standards.
- Clause 9, Safety and environmental precautions, is revised to delete reference to specific U.S. regulatory agencies.
- The standard is metric only.
- Minimal editorial changes have been incorporated.

The first draft of ANSI/AGMA 2007–C00 was made in August, 1998. It was approved by the AGMA membership on March 2, 2000. It was approved as an American National Standard on November 2, 2000.

Suggestions for improvement of this standard will be welcome. They should be sent to the American Gear Manufacturers Association, 1500 King Street, Suite 201, Alexandria, Virginia 22314.

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American National Standard –

Gears – Surface Temper Etch Inspection After Grinding

1 Scope

This standard specifies standard procedures and requirements for the detection and classification of localized overheating on ground surfaces by chemical etch methods.

Some methods which have been used in the past are no longer recommended. Specifications should be changed to use the methods in this standard. These etching methods are more sensitive to changes in surface hardness than most hardness testing methods.

This standard applies to steel parts, such as gears, shafts, splines and bearings, but is not applicable to nitrided parts and stainless steels.

NOTE: This process, although at times called “nital etch”, should not be confused with other processes also known as “nital etch”.

The surface temper etch procedure is to be performed after grinding and before additional finishing operations.

2 Equipment

2.1 Container materials

Container materials shall not react with the solutions contained, nor damage the parts to be processed. All containers shall be labelled with the solution contained and covered when not in use.

2.2 Inspection area

The area to be inspected shall be sufficiently illuminated to be free of shadows and reflections. Light capable of ensuring 3200 lux (300 foot candles) at the inspection level is recommended.

2.3 Timing device

A suitable timing device shall be used for the uniform processing of all parts in a group.

2.4 Cleaner

An alkaline cleaner, vapor degreaser, solvent wash, or equivalent cleaning process should be used.

3 Reagents

All chemicals shall be technical grade or better.

3.1 Cleaning materials

Cleaning materials shall be used which are capable of ensuring removal of all dirt, grit, grease and oil, to obtain a “water break” free surface. A “water break” free surface is one which maintains a continuous water film for a minimum period of 15 s after having been rinsed in clean water at a temperature below 40°C.

3.2 Nitric acid

$\rho = 1.42$ g/ml

3.3 Hydrochloric acid

$\rho = 1.19$ g/ml

3.4 Alcohol

Methanol or denatured ethanol, clean and free of contaminants such as oil, should be used.

3.5 Water

Clean and free of contaminants.

3.6 Alkaline solution

A solution such as 4% to 6% sodium hydroxide in water with a minimum pH value of 10, or 13% to 17% ammonium hydroxide in alcohol, should be used.

3.7 Rust preventive oil

A suitable rust preventive oil which does not mask the results of etching.