
Porušitveni preskusi zvarov na kovinskih materialih - Jedkala za makroskopsko in mikroskopsko preiskavo (prevzeta CR 12361:1996 in CR 12361:1996/AC:1997 z metodo platnice)

Destructive tests on welds in metallic materials - Etchants for macroscopic and microscopic examination

Essais destructifs des soudures sur matériaux métalliques - Réactifs pour examen macroscopique et microscopique

Zerstörende Prüfung von Schweißverbindungen an metallischen Werkstoffen - Ätzungen für die makroskopische und mikroskopische Untersuchung

Deskriptorji: porušitveno preskušanje, zvarni spoj, jedkanje

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NACIONALNI UVOD

Tehnično poročilo SIST CR 12361 ((sl),de), Porušitveni preskusi zvarov na kovinskih materialih - Jedkala za makroskopsko in mikroskopsko preiskavo, prva izdaja, 1999, ima status slovenskega tehničnega poročila in je z metodo platnice prevzeto evropsko poročilo CR 12361 (de), Zerstörende Prüfung von Schweißverbindungen an metallischen Werkstoffen - Ätzungen für die makroskopische und mikroskopische Untersuchung, 1996-04-00 in dodatek CR 12361:1996/AC:1997, v nemškem jeziku.

NACIONALNI PREDGOVOR

Evropsko poročilo CR 12361:1996 je pripravil tehnični odbor Evropskega komiteja za standardizacijo CEN/TC 121 Varjenje.

Pripravo tega poročila sta CEN poverila Evropska komisija in Evropsko združenje za prosto trgovino. To evropsko poročilo ustreza bistvenim zahtevam evropske direktive 97/23/EEC.

Odločitev za prevzem tega poročila po metodi platnice je dne 1998-10-30 sprejel tehnični odbor USM/TC VAR Varjenje.

To slovensko poročilo je dne 1998-10-12 odobril direktor USM.

OPOMBI

- Povsod, kjer se v besedilu poročila uporablja izraz "evropsko poročilo", v SIST CR 12361:1999 to pomeni "slovensko tehnično poročilo".
- Nacionalni uvod in nacionalni predgovor nista sestavni del poročila.

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CR 12361:1996

April 1996

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English version

Destructive tests on welds in metallic materials -
Etchants for macroscopic and microscopic
examination

iTeh STANDARD PREVIEW

Essais destructifs des soudures sur
matériaux métalliques - Réactifs
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Foreword

This technical report was prepared by the technical committee CEN/TC 121 "Welding", of which the secretariat is held by DS.

The technical committee agreed to publish this technical report.

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1 Scope

This technical report gives a non exhaustive list of etchants which can be used for the macroscopic and microscopic examination of welds in accordance with EN 1321 for the following groups of materials :

- carbon and low alloyed steels ;
- stainless steels ;
- nickel and nickel alloys ;
- titanium and titanium alloys ;
- copper and copper alloys ;
- aluminium and aluminium alloys.

2 Normatives references

This european technical report incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this european technical report only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

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EN 1321 Destructive tests on welds in metallic materials - Macroscopic and microscopic examination of welds

3 General

Where details of concentration or waters of crystallisation of reagents are not defined in the annexes, the table 1 apply. These should be confirmed by the suppliers of each etchant.

Table 1: Characteristics of components

Components	Characteristics			
	Specific gravity g/cm ³	Concentration %	Hydrat	Remarks
HCl	1,18 1,16	35 to 38 31,5 to 33	-	
HF	1,13	40	-	
HNO ₃	1,42	69	-	
H ₂ SO ₄	1,84	98	-	
H ₂ O ₂	-	6 % W/V ¹⁾	-	Usually 20 volumes (i.e. 20 volume available O ₂).
H ₃ PO ₄	1,70	85	-	
CH ₃ COOH	1,05	99,1	-	glacial
HF ₄	1,40	50	-	
C ₂ H ₂ O ₄	-	-	2	
FeCl ₃	-	-	6	
CuCl ₂	-	-	2	
MgCl ₂	-	-	6	
Fe(NO ₃) ₃	-	-	9	

1) W/V means weight by volume

4 Etchants for carbon and low alloyed steels

The etchants for carbon and low alloyed steels are given in annex A.

5 Etchants for stainless steels

The etchants for stainless steels are given in annex B.

6 Etchants for nickel and nickel alloys

The etchants for nickel and nickel alloys are given in annex C.

7 Etchants for titanium and titanium alloys

The etchants for titanium and titanium alloys are given in annex D.

8 Etchants for copper and copper alloys

The etchants for copper and copper alloys are given in annex E.

9 Etchants for aluminium and aluminium alloys

The etchants for aluminium and aluminium alloys are given in annex F.

10 Designation

Etchants should be designated either by names or by numbers of tables in accordance with annex G.

Annex A (informative)

Etchants for carbon and low alloyed steels

See tables A.1 to A.13

Table A.1 : Nital

Type of etchant : Macroscopic and microscopic etchant
Composition in volume and in order of mixing 99 ml to 95 ml industrial methylated spirits* 1 ml to 5 ml nitric acid (HNO ₃) * ethyl alcohol (C ₂ H ₅ OH), denatured with methyl alcohol (CH ₃ OH) Also methyl alcohol or isoamyl alcohol [(CH ₃) ₂ CH(CH ₂) ₂ OH]
Safe shelf life : Indefinite
Surface preparation 600 grit or finer (macroetching ≈ 5 % of nitric acid) 3 μm diamond or finer (microetching ≈ 2 % of nitric acid)
Etching temperature : Ambient
Etching time : Few seconds - check by eye
Additional precautions/requirements Usual precautions for handling and disposal of acids.
Comments Can increase strength to 15 % for macroetching on ground surface - reveals ferrite boundaries - differentiates ferrite from martensite. Good general purpose etchant. Amyl alcohol is preferable for galvanized steel.

Table A.2 : Picral (4 %)

Type of etchant : Microscopic etchant
Composition in volume and in order of mixing 100 ml ethyl alcohol (C ₂ H ₅ OH) 4 g picric acid [C ₆ H ₂ OH(NO ₂) ₃] [+ wetting agent (sodium dodecyl benzene sulphat) (C ₁₈ H ₂₉ NaSO ₃) if required]
Safe shelf life : Indefinite
Surface preparation 3 µm diamond or finer
Etching temperature : Ambient
Etching time : Few seconds - check by eye
Additional precautions/requirements Usual precautions for handling and disposal of acids.
Comments Little attack prior austenite boundaries - detects carbides - good resolution with fine pearlite, martensite, tempered martensite and bainitic structures.

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Table A.3 : Picric acid solution

Type of etchant : Microscopic etchant
Composition in volume and in order of mixing 1 l saturated aqueous picric acid [C ₆ H ₂ OH(NO ₂) ₃] 10 ml wetting agent (sodium dodecyl benzene sulphate) (C ₁₈ H ₂₉ NaSO ₃)
Safe shelf life : Indefinite
Surface preparation 3 µm diamond or finer
Etching temperature : 55 °C to 60 °C
Etching time : Few seconds - check by eye
Additional precautions/requirements Usual precautions for handling and disposal of acids.
Comments Reveals prior grain boundaries and segregation.

Table A.4 : Picral (15 %)

Type of etchant : Microscopic etchant
Composition in volume and in order of mixing 100 ml ethyl alcohol* (C ₂ H ₅ OH) 15 g picric acid [C ₆ H ₂ OH(NO ₂) ₃]
* Also methyl alcohol (CH ₃ OH)
Safe shelf life : Indefinite
Surface preparation 2 µm diamond or finer
Etching temperature : Ambient
Etching time : Few seconds to a minute - Check by eye
Additional precautions/requirements Usual precautions for handling and disposal of acids.
Comments Reveals general structure. Composition given will saturate the solution with picric acid.

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Table A.5 : Hydrochloric picric acid solution
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Type of etchant : Microscopic etchant
Composition in volume and in order of mixing 100 ml ethyl alcohol (C ₂ H ₅ OH) 1 ml hydrochloric acid (HCl) 4 g picric acid [C ₆ H ₂ OH(NO ₂) ₃]
Safe shelf life : Indefinite
Surface preparation 3 µm diamond or finer
Etching temperature : Ambient
Etching time : 10 s to few minutes
Additional precautions/requirements Usual precautions for handling and disposal of acids.
Comments Microstructural characterization of HAZ, weld and parent metal. Especially effective for very fine structures. Less effective than Nital for the ferrite grain boundaries.