
**Vitreous and porcelain enamels —
Terminology —**

**Part 2:
Visual representations and
descriptions**

iTeh STANDARD PREVIEW
Émaux vitrifiés — Terminologie —
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Partie 2: Représentations visuelles et descriptions

ISO 19496-2:2017

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 107, *Metallic and other inorganic coatings*.

A list of all parts in the ISO 19496 series can be found on the ISO website.

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Vitreous and porcelain enamels — Terminology —

Part 2: Visual representations and descriptions

1 Scope

This document establishes a system for the cataloguing of defects in sheet steel enamelling. It serves for a consistent language use concerning the designation and characterization of enamelling defects. This document is limited to detectable defects and does not purport to fully take into consideration all occurring types of defects. It does not evaluate enamelling defects; the classification carried out serves for the conveyance of practical knowledge.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

4 Enamelling defects

4.1 Chipping

4.1.1 Further designations

- spalling
- pop-offs
- peeling
- delamination

4.1.2 Description

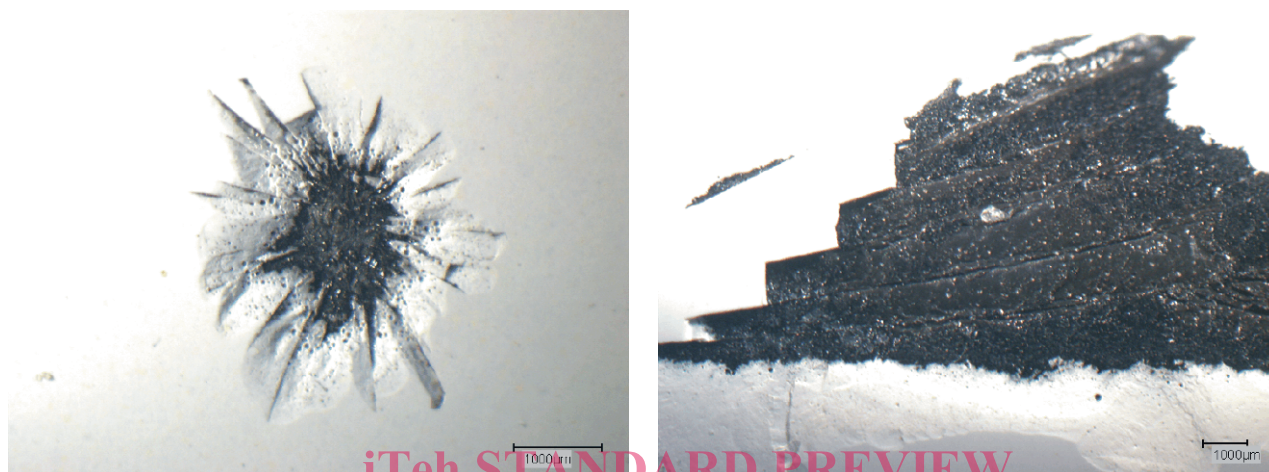
Chipping (see [Figure 1](#)) is surface detachment of the vitreous enamel exposing the layer below or also the substrate.

4.1.3 Origin and causes

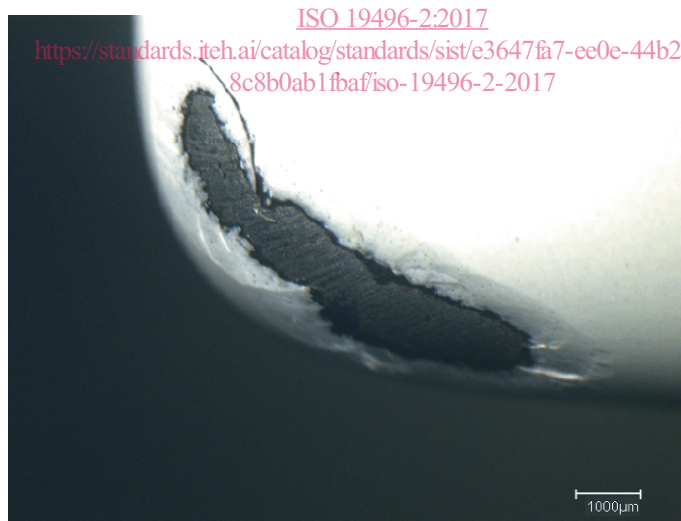
Chipping occurs if the stress in the vitreous enamel layer is too great or the adhesion between the vitreous enamel and the substrate is too low.

Possible causes are

- compressive stress in the enamel layer which is too high, due to incorrect material combination or a construction not suitable for enamelling,
- poor adherence of the vitreous enamel layer on the sheet steel,
- mechanical stress, and
- thermal stress.



a) Pop-off resulting from impact on the rear side (standards.iteh.ai) b) Chipping resulting from too high a compressive stress



c) Chipping resulting from too high a compressive stress and poor adherence

Figure 1 — Spalling

4.2 Lines

4.2.1 Hairlines

4.2.1.1 Further designations

- strain lines
- tension lines

4.2.1.2 Description

Continuous, clearly defined line (see [Figure 2](#)) in the vitreous enamel surface; single, parallel or concentric.

4.2.1.3 Origin and causes

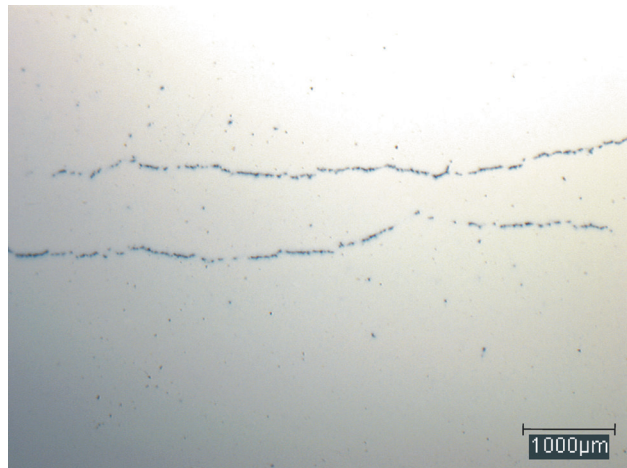
Hairlines result from reactions during the firing of the vitreous enamel.

Possible causes are

- lamination or rolled-in scale in the steel (rolling lines),
- pre-treatment residue,
- crazing in vitreous enamel layers underneath,
- uneven heating-up, especially work pieces which have differing wall thicknesses,
- construction of parts which are unsuitable for enamelling,
- vitreous enamel layer too thick,
- vitreous enamel too finely milled,
- incorrect matching of ground-coat and cover coat enamel with regard to the smelting behaviour,
- insufficient firing grate supports,
- unequal temperature distribution in the furnace,
- use of outdated steel despite low deformation, and
- too low a yield strength of the substrate.



a) Hairlines, top view



b) Hairlines, top view [corresponding cross section; see [Figure 2 c\)](#)]



c) Cross section of two hairlines which result from too soft or too finely milled ground-coat

Figure 2 — Hairlines

4.2.2 Bubble lines

4.2.2.1 Further designations

- pearl lines

4.2.2.2 Description

Linearly open or closed blisters located in the vitreous enamel surface (see [Figure 3](#)).

4.2.2.3 Origin and causes

Bubble lines are a result of gas-forming reactions in the firing of the vitreous enamel.

Possible causes are

- lamination or rolled-in scale in the steel (rolling lines),

- pre-treatment residue,
- contamination of the substrate surface,
- crazing in the vitreous enamel layers underneath,
- vitreous enamel layer too thick,
- poor weld seam production, and
- incorrect filler material for weld seam.



Figure 3 — Bubble line as a result of lamination

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4.2.3 Watermarks

4.2.3.1 Further designations

- shorelines
- water streaks

4.2.3.2 Description

Continuous, not clearly defined line (see [Figure 4](#)) in the vitreous enamel surface; single, parallel or dispersing.

4.2.3.3 Origin and causes

Watermarks occur during application of the slip.

Possible causes are

- localized salt accumulation during slip drying,
- recondensation in hollow bodies during uneven drying,
- incorrect slip consistency,
- inappropriate application technique, and
- inappropriate substrate design.