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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 20972.1-2026

Replacing GB/T 20972.1-2007

**Petroleum and natural gas industries - Materials for use in
H₂S-containing environments in oil and gas production - Part 1:
General principles for selection of cracking-resistant materials**

石油天然气工业 油气开采中用于含硫化氢环境的材料 第1部分：选择抗开裂材料
的一般原则

(English Translation)

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Foreword

This document complies with the provisions of GB/T 1.1-2020 "Standardization Work Guidelines Part 1: Structure and Drafting Rules of Standardization Documents".

Drafting.

This document is Part 1 of GB/T 20972 "Materials for use in hydrogen sulfide-containing environments in oil and gas extraction in the petroleum and natural gas industry".

GB/T 20972 has published the following parts.

---Part 1: General Principles for Selecting Crack-Resistant Materials;

---Part 2: Crack-resistant carbon steel, low-alloy steel and cast iron;

---Part 3: Crack-resistant and corrosion-resistant alloys and other alloys.

This document replaces GB/T 20972.1-2007 "Materials for Hydrogen Sulfide-Containing Environments in Oil and Gas Extraction in the Petroleum and Natural Gas Industry - Part 1".

Part 1: General Principles for Selecting Crack-Resistant Materials. Compared with GB/T 20972.1-2007, the main changes are structural adjustments and editorial modifications.

The technological changes are as follows.

- a) The scope of application has been changed (see Chapter 1, Chapter 1 of the 2007 edition);
- b) The terms "electrical coupling-induced hydrogen stress cracking," "chemical activity," and "fugacity" have been added (see Chapter 3);
- c) The description of the evaluation method for materials using strain-based design methods has been revised (see Chapter 5, Chapter 5 of the 2007 edition);
- d) Added guidance on environmental severity assessment for gaseous and liquid systems containing hydrogen sulfide (see Chapter 6).

This document is modified to adopt ISO 15156-1:2020 "Materials for use in hydrogen sulfide environments in the oil and gas industry - Part 1" Part 1: General Principles for Selecting Crack-Resistant Materials.

This document differs significantly from ISO 15156-1:2020. The relevant clauses are indicated in the margins using vertical markers.

Straight lines (|) are indicated. These technical differences and their reasons are as follows.

---The scope of this document has been amended to explicitly exclude uniform corrosion, localized corrosion, and corrosion fatigue (see Chapter 1);

---GB/T 20972.2 replaces ISO 15156-2, and GB/T 20972.3 replaces ISO 15156-3 (see GB/T 20972.2).

Chapters 2 and 5 through 9 are included to meet the requirements of my country's standard system documents.

---The wording of some terms in Chapter 3 has been revised, with descriptive text in the definitions of "cold working" and "hardness" now indicated by footnotes.

(See 3.5, 3.9), descriptive text in the definitions of "corrosion-resistant alloys" and "welding" has been deleted (see 3.6, 3.25), and in the definition of "acidic environment"...

The content of the notes shall be included in the main text (see 3.20) to comply with the requirements of my country's standard system documents;

---The abbreviation "electrically induced hydrogen stress cracking" has been added (see Chapter 4);

---The provision that "laboratory tests can only simulate the field environment as much as possible" (see 8.3.1) has been removed to align with domestic operating practices. This article the following editorial changes were made to the document.

---The hierarchical arrangement of the content has been changed (see Chapter 5);

---Note 2 has been removed. "No guidance was given regarding the equivalent region or limitation of H₂S fugacity in the gas phase or H₂S chemical activity in the aqueous phase."

Descriptive text (see 6.1) should be included to meet the requirements of my country's standard system documents.

---The position of the content in the "example" has been changed so that it is required to be stated in the main text (see 8.3.1).

Please note that some content in this document may involve patents. The issuing organization of this document assumes no responsibility for identifying patents.

This document was proposed and is under the jurisdiction of the National Technical Committee on Standardization of Petroleum Drilling Equipment and Tools (SAC/TC96).

Introduction

Sulfide stress cracking and stress corrosion cracking are dangerous failure modes in hydrogen sulfide-containing oil and gas extraction, and are used in pressure-bearing applications in hydrogen sulfide environments.

Equipment materials may crack unpredictably and rapidly, causing significant loss of life and property. GB/T 20972 "Petroleum and Natural Gas..." the purpose of the document "Materials for Use in Hydrogen Sulfide-Containing Environments in Oil and Gas Extraction" is to standardize crack-resistant materials used in hydrogen sulfide-containing environments during oil and gas extraction.

The requirements for material evaluation, selection, and application were formulated with reference to relevant domestic and international standards such as GB/T 20972.2, GB/T 20972.3, and ISO 15156.

The standard incorporates research findings and practical experience from recent years in basic research and technical standards for engineering applications in acidic oil and gas fields, and is proposed to be developed by three departments.

Composition.

---Part 1: General Principles for Selecting Crack-Resistant Materials. The aim is to establish general principles for defining the service environment, evaluating materials, and selecting materials.

in principle.

---Part 2: Crack-resistant carbon steel, low-alloy steel, and cast iron. The aim is to establish the selection, evaluation, and...

Usage requirements, and usage requirements for cast iron.

---Part 3: Crack-resistant and corrosion-resistant alloys and other alloys. The aim is to establish a selection and evaluation system for crack-resistant and corrosion-resistant alloys and other alloys.

Specifications and usage requirements, including austenitic stainless steel, martensitic stainless steel, ferritic stainless steel, duplex stainless steel, nickel-based alloys, and titanium alloys.

Gold, etc.

Oil and gas extraction in the oil and gas industry Materials for use in hydrogen sulfide environments Part 1: General Principles for Selecting Crack-Resistant Materials

1 Scope

This document specifies the evaluation and selection of metallic materials for equipment used in hydrogen sulfide (H₂S) environments at oil and gas extraction and natural gas processing plants.

General principles, requirements, and recommended methods.

This document applies to the selection and evaluation of crack-resistant materials for equipment designed and manufactured using load-controlled design methods.

Note 1: Cracking includes sulfide stress cracking (SSC), stress corrosion cracking (SCC), hydrogen-induced cracking (HIC), stepped cracking (SWC), and stress-directed hydrogen-induced cracking.

The study includes stress cracking (SOHIC), soft zone cracking (SZC), and galvanic hydrogen stress cracking (GHSC), excluding uniform corrosion, localized corrosion, and corrosion fatigue.

Note 2: The metallic materials selected and evaluated according to this document are crack-resistant in hydrogen sulfide-containing environments as specified in this document during oil and gas extraction, but this does not mean they are immune to cracking.

It can prevent cracking in all usage environments.

2 Normative references

The contents of the following documents, through normative references within the text, constitute essential provisions of this document. Dated citations are not included.

For references to documents, only the version corresponding to that date applies to this document; for undated references, the latest version (including all amendments) applies.

This document.

GB/T 20972.2 Materials for use in hydrogen sulfide-containing environments during oil and gas extraction in the petroleum and natural gas industry - Part 2: Crack-resistant carbon Steel, low-alloy steel and cast iron (GB/T 20972.2-2025, ISO 15156-2:2020, MOD) GB/T 20972.3 Materials for use in hydrogen sulfide-containing environments during oil and gas