ICS 77.040.99
CCS H 24

NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 38913-2020

Test method for the hydride orientation factor of nuclear grade zirconium and zirconium alloys

核级锆及锆合金管材氢化物取向因子检测方法

Issued on: June 2, 2020 **Implemented on: May 1, 2021**

Issued by: State Administration for Market Regulation;
Standardization Administration of the PRC

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Foreword

This standard was drafted in accordance with the rules given in GB/T 1.1-2009. This standard was proposed by China Nonferrous Metals Industry Association. This standard is under the jurisdiction of the National Nonferrous Metals Standardization Technical Committee (SAC/TC243). This standard was drafted by: National Nuclear Baozi Zirconium Co., Ltd., National Nuclear Zirconium Hafnium Physical and Chemical Testing Co., Ltd., Baoji Titanium Industry Co., Ltd., West Ministry of New Zirconium Nuclear Material Technology Co., Ltd., Xi'an Hantang Analysis Testing Co., Ltd., Baoji Titanium New Material Testing Technology Center Co., Ltd., Non-ferrous Metal Technology and Economic Research Institute. The main drafters of this standard. Zhang Tianguang, Li Gang, Zhang Mengni, Wei Xinmin, Li Xianjun, Shi Wen, Li Fan, Wang Songmao, Yang Yan, Li Xiaoning, Yue Qiang, Zhang Jiangfeng. Nuclear grade zirconium and zirconium alloy pipe hydride orientation factor Detection method Warning

---Persons using this standard should have practical experience in formal laboratory work. This standard does not indicate all possible safety issues question. It is the user's responsibility to take appropriate safety and health measures and to ensure compliance with the conditions prescribed by the relevant national regulations.

1 Scope

China's national test method for the hydride orientation factor of nuclear grade zirconium and its alloys. Zirconium alloy fuel cladding absorbs hydrogen throughout its life in a reactor, from the corrosion reaction with the coolant, and beyond its solubility limit that hydrogen precipitates as zirconium hydride platelets in the metal. Whether those platelets are a problem depends almost entirely on their orientation. Hydrides lying circumferentially, in the plane of the tube wall, are largely harmless; hydrides oriented radially, across the wall, are brittle paths straight through the only barrier between the fuel and the coolant, and they are what causes delayed hydride cracking. The orientation is set by the texture of the tube from its manufacture and by the stress present when the hydrides precipitate. Measuring the fraction that is radial is therefore a direct measure of how the cladding will behave, and it is done metallographically on a polished cross-section.

This standard stipulates the method for detecting the orientation factor of hydride of nuclear grade zirconium and zirconium alloy pipes. This standard is applicable to the determination of the orientation factor of hydride of nuclear grade zirconium and zirconium alloy pipes through hydrogen permeation or gas permeation of autoclaves.

2 Normative references

The following documents are essential for the application of this document. For dated reference documents, only the dated version applies to this article Pieces. For the cited documents without date, the latest version (including all amendments) applies to this document.

GB/T 13298 Metal microstructure inspection method

3 Terms and definitions

The following terms and definitions apply to this document.

3.1 Hydride A compound formed by hydrogen and a more metallic metal.

3.2 Radial hydride On a certain inspection section of zirconium and zirconium alloy pipes, the radial angle (theta) between the hydride and the pipe is not greater than the product standard and technical conditions Or the requirements of the demand side, and its actual length is not less than 15μm hydride.

3.3 Hydride count On a certain inspection section of zirconium and zirconium alloy pipes, the number of hydrides whose actual length is not less than 15μm is counted.

3.4 Radial hydride count Ntheta On a certain inspection section of zirconium and zirconium alloy pipes, the number of radial hydrides (3.2) is counted.

3.5 Hydride orientation factor Fthetan The ratio of the number of radial hydrides (3.4) to the number of hydrides (3.3) on a certain inspection section of zirconium and zirconium alloy pipes.