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Test method for estimating average grain size of microalloying non-quenched and tempered steel and its products

非调质钢及其制品平均晶粒度检验方法

(English Translation)

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Foreword

In order to facilitate the evaluation of the austenite grain size growth tendency of non-quenched and tempered structural steel under forging heating or controlled cooling after forging, and non-quenching and tempering the actual grain size of steel rolling, forging, and forgings is specially formulated for this standard.

Compared with quenched and tempered steel parts, the austenite formation temperature of non-tempered steel forgings is higher, and the same austenite crystal as quenched and tempered steel is used.

The particle size formation temperature is inconsistent with the actual process state. Non-quenched and tempered steel rolled, forged or forged structures may be "flaky pearlite" "Ferrite", flake pearlite, low carbon martensite, granular bainite, etc. For the first two microstructure states, the evaluation of the actual grain size the method is not specifically stipulated in GB/T 6394-2002 "Method for determination of metal average grain size".

This standard complies with GB/T 6394-2002 "Method for Determining the Average Grain Size of Metals".

The production process and organizational characteristics are adapted.

Appendix A of this standard is a normative appendix.

This standard was proposed by the Material Branch of the Chinese Society of Automotive Engineers.

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This standard was approved by the Chinese Society of Automotive Engineers.

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This standard was drafted. Dongfeng Motor Corporation, China FAW Group Corporation, Jiangling Automobile Co., Ltd., Northeast Special Iron and Steel Co., Ltd., Jiangyin Xingcheng Special Steel Co., Ltd., Hubei Xinye Steel Co., Ltd., and Shougang Group Co., Ltd.

4.1 Formation conditions of austenite grain size of non-quenched and tempered steel

The austenite grain size of non-quenched and tempered steel reflects the fine grain of non-quenched and tempered steel obtained under forging controlled cooling, controlled rolling controlled cooling or forging waste heat quenching the ability of organization should be the same as the original austenite that can be obtained stably before the non-quenched and tempered steel rolling or forgings undergo low temperature solid phase transformation after hot forming Grain size corresponds.

The external process factors affecting the austenite grain size of non-quenched and tempered steel in the use state include. forging heating temperature and holding time, Final forging temperature, deformation and deformation rate, cooling rate in high temperature area after forging (rolling), etc. In fact, in the hot rolling or forging Under the premise of force and efficiency, the process factors that can be used to refine the grain are usually only the cooling rate (time) in the high temperature region after forging (rolling) and Final forging (rolling) temperature; and under specific process conditions, the final forging (rolling) temperature and forging (hot rolling) heating temperature (1150 °C ~ 1250 °C) has a corresponding relationship, the former is generally 50 °C ~ 250 °C lower than the latter.

In order to facilitate the stability of the test conditions, the formation condition of the essential grain size of non-quenched and tempered steel is. it will be taken from raw materials, and the effective size is not large the sample at phi25 is heated to 950 °C ~ 1200 °C and held for 5 minutes to 15 minutes. The heating temperature corresponds to the final (rolling) forging temperature, the holding time corresponds to the cooling rate or time in the high temperature region after forging, the specific values of the heating temperature and the holding time and the forged (rolled) product the size is related to the forging process and is determined experimentally.

The location of the specimen to be cut shall be performed in accordance with the sampling position of tensile or impact specimens specified in GB/T 2975; the preparation of the specimen shall be in accordance with GB/T 13298 get on.

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4.2 Display and determination of essential grain size of non-quenched and tempered steel

4.2.1

For the display of the intrinsic grain size of non-quenched and tempered steel, it is recommended to use the direct hardening method or the ferrite mesh method to fix the original austenite grain boundaries.

Direct hardening method. After austenitizing the sample under the conditions specified in 4.1, it is quenched at a cooling rate capable of being completely hardened to obtain martensite.

After being ground, polished and etched, the body structure shows the original austenite morphology which is completely hardened into martensite. Etching method and etchant selection, refer to C.3.1.5 in GB/T 6394.

Ferrite mesh method. After austenitizing the sample under the conditions specified in 4.1, the sample is cooled in a cooling manner capable of obtaining reticulated ferrite.

The "reticulated ferrite pearlite" or "reticulated ferrite martensite, bainite" structure is obtained. After grinding, polishing and etching, the original the reticulated ferrite precipitated at the austenite grain boundaries shows the original austenite grains. Sample cooling method, etching method and etchant selection, refer to C.3.1.2 of GB/T 6394.

4.2.2

The method and selection of austenite grain size of non-quenched and tempered steel shall be in accordance with GB/T 6394.

5 Inspection method of actual grain size of non-quenched and tempered steel products

5.1

Non-quenched and tempered steel products that need to be tested for actual grain size may include non-quenched and tempered steel hot-rolled steel bars, steel tubes, and Non-quenched and tempered steel forgings.

5.2

The actual grain size sample shall be taken from the sample or sample under delivery.

For cold-drawn or hot-rolled non-quenched and tempered steel hot-rolled steel bars and steel pipes, the sampling location refers to the tensile or impact specified in GB/T 2975.

The sample sampling position is required to be performed, and the preparation of the sample is performed according to GB/T 13298.

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For non-quenched and tempered steel forgings, the sampling position should meet the metallurgical technical requirements of related products Evaluate the actual grain size); for eutectoid steel or "pearlite-ferrite" non-quenched and tempered steel forgings with low ferrite content, Selection should also consider the display of grain size.

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Adoption of the standard is entirely voluntary, its availability and applicability for any particular purpose, including possible the other risks of the user shall be borne by the adopter.

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