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Metallic materials - Determination of residual stress - Hole drilling strain gauge method

金属材料 残余应力测定 钻孔应变法

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Foreword

This standard was drafted in accordance with GB/T 1.1-2009 given rules. The standard proposed by China Iron and Steel Association. This standard by the National Steel Standardization Technical Committee (SAC/TC183) centralized. This standard was drafted. Wuhan Iron and Steel (Group) Corporation, Institute of Metal Research, Shanghai Entry-Exit Inspection and Quarantine Bureau, Wuhan the University. The main drafters of this standard. IRON Chen Huaining, Wu Yiwen, coating should macros, Yu Li, Zhu Lihong, Qiubao Wen, Liu Dong, Xue Huan, Imperial Concubines Wang selected country, Hou mass.

Residual stress exists in almost all materials, are likely to produce residual stress in the workpiece during the manufacturing process or service. Especially for Those artifacts alternating loads or corrosive environments in service, if there is no consideration or accounting residual stress in the design process, it turns One of the important factors that cause material failure. Residual stress may also be useful, e.g., compressive stress generated by shot peening. Drilling Strain (under Referred to as the drilling method) is a method for determining residual stresses. Drilling method for measuring residual stress in an isotropic linear elastic material near the surface. Comprising the steps of. the strain put on the surface of the object Flowers, then take the strain drilling, and then measure the object surface released strain. The measured strain can be substituted into a series of formulas Calculate the material has been removed portion where the residual stresses. Drilling method of destruction caused by the workpiece is limited to a smaller area, for thicker materials, not usually into Positive Often use a serious impact, so called "semi-destructive" testing. In contrast, most other mechanical residual stress measurement methods will Causing serious damage to the workpiece. Due to the number of drilling method will cause some damage to the workpiece, the method only for drilling on the workpiece Hole (or after drilling through welding Buxiu mill) does not seriously affect its

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function under the case. There are two different ways of measuring residual stress.

a) high-speed drilling residual stress measurement method, that method A. Finite element analysis of stress due to the high-speed drill machining strain is small, residual stress measurement can be entirely in accordance with the formula obtained by Cauchy Calibration constants are calculated.

b) low-speed drill residual stress measurement method, that method B. Due to the low-speed drill work strain is relatively large, can not be ignored, the measurement of residual stress through stress comprehensive calibration tests obtained Calibration constants calculated. Theoretically, if the isotropic (isometric) residual stress exceeds 50% of the yield strength of the material, or in either direction shear stress exceeds the yield 25% of the strength of the service, may be due to the surrounding borehole stress concentration and localized yielding. But in practice there are reliable data show that the residual stress of not More than 60% of the material yield strength of this standard can still use (this limit is only determined for non-square test calibration calibration constant stress Method, Method A method of determining the. If the residual stress measurement of high material yield point, such as welding stress, at this time need a special set of Test calibration techniques, such as the calibration method B) [2]. Metallic material residual stress measurement method of borehole strain

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1 Scope

China's national standard for determining residual stress in metallic materials by the hole drilling strain gauge method. It specifies the principle, the equipment, the specimens, the procedure, the calculation and the report for the method, and it applies to the determination of residual stress near the surface of isotropic linearly elastic materials. The hole drilling method is the most widely used residual stress technique in industry, and the reason is that it is only semi-destructive. A strain gauge rosette is bonded to the surface, a small hole is drilled at its centre, and the strains that appear as the material around the hole relaxes are measured and converted into the residual stresses that were present before drilling. The damage is confined to a small area, and on a thick component it usually has no significant effect on function - and where it does, the hole can be welded up and dressed. Every other mechanical method causes serious damage to the workpiece by comparison. The standard gives two variants distinguished by how the hole is made. Method A uses high speed drilling: finite element analysis shows that the machining strain introduced by a high speed drill is small, so the residual stress can be calculated directly from the Cauchy formulae using calibration constants. Method B uses low speed drilling, which introduces more machining strain and therefore requires a different treatment. Residual stress exists in almost every material and is produced by almost every manufacturing process; where a component sees alternating loads or a corrosive environment and the residual stress was not considered in design, it becomes one of the important causes of failure - though it can

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also be beneficial, as with the compressive stress produced by shot peening. Issued on 5 December 2014 and in force since 1 September 2015.

This standard specifies the test outlined determination of the elastic material near the surface of a metallic material isotropic linear residual stress using the drilling method, measurement devices Equipment, measurement procedures, calibration constant stress calculation, measurement error correction and the like. Drilling method for measuring the inner surface of the metal material stress gradient less stress state, the residual stress in this state may be in the depth direction No change, approximately constant (uniform stress), there may be significant changes (non-uniform stress) in the depth direction. As a result of drilling only mode Plane residual stress can be measured near the surface of the material, and therefore the size of the drilling method can only be measured by drilling holes in the inner boundary of the local residual stresses.

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2 Normative references

The following documents for the application of this document is essential. For dated references, only the dated version suitable for use herein Member. For undated references, the latest edition (including any amendments) applies to this document. JJG623 resistance strain gauges

3 Terms and Definitions

The following terms and definitions apply to this document.

3.1 Stress calibration constants calibrationconstantforstresses Information residual stress and strain release scale factor. In borehole strain method, the resistance strain gauge geometry, pasting position, the hole The shape and size.

3.2 Strain Release relievedstrain The structural member having a stress field drilling, the amount of change before and after its drilling strain.

3.3 Thin workpieces thinworkpiece The thickness of the circular diameter smaller than the bore diameter of the workpiece or strain to spend.

3.4 Thick workpiece thickworkpiece Many artifacts than the thickness of the large diameter drilling.

3.5 Medium thickness of the workpiece intermediatethicknessworkpiece Thick and thin workpiece workpiece workpiece in between.

3.6 High-speed drilling high-speedhole-driling Speed \u200b\u200binto the hole in the tens of thousands of revolutions per minute or more, cutting a small amount of processing methods.

3.7 Low-speed drill low-speedhole-driling Pore-forming speed of thousands of revolutions

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per minute, especially a hand drill processing methods.

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