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Gas nitrocarburizing of iron and steel parts

钢铁件的气体碳氮共渗

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Gas nitrocarburizing of iron and steel parts

1 Scope

This standard specifies the requirements for common materials, equipment, process, inspection, energy consumption, safety and hygiene for nitrocarburizing of steel parts, in nitrogen and carbon-containing gas media.

This standard applies to the gas nitrocarburizing treatment of steel parts.

2 Normative references

The provisions in following documents become the provisions of this Standard through reference in this Standard. For the dated references, the subsequent amendments (excluding corrections) or revisions do not apply to this Standard; however, parties who reach an agreement based on this Standard are encouraged to study if the latest versions of these documents are applicable. For undated references, the latest edition of the referenced document applies.

GB 536-1988 Liquid Anhydrous Ammonia

GB/T 699 Quality carbon structural steels

GB/T 700 Carbon structural steels (GB/T 700-2006, ISO 630:1995, NEQ)

GB/T 1182 Geometrical product specifications (GPS) - Geometrical tolerancing - Tolerances of form orientation location and run-out (GB/T 1182-2008, ISO 1101:2004, IDT)

GB/T 1299 Alloy tool steels

GB/T 1348 Spheroidal graphite iron castings

GB/T 3077 Alloy structure steels

GB 3095 Ambient air quality standard

GB/T 7232 Terminology of metal heat treatment

GB/T 8121 The terminology of technological materials for heat treatment

GB/T 9439 Grey iron castings

GB/T 9452 Testing method for work zone of heat treatment furnace

GB/T 11354 Determination of nitrided case depth and metallographic microstructure examination for steel and iron parts

GB/T 12603 Classifications and designations for metal heat treatment

GB/T 13324 Terminology of heat treatment equipment

GB 15735 Requirements for the safety and health in production process of metal heat treatment

GB/T 17358 Power consumption measurement and testing in heat treating production

GB/T 19944 Fuel consumption quota and its counting and testing method for heat treating production

JB/T 6050 Generalization of hardness test for heat treated iron and steel parts

JB/T 9209 Technical requirement of medium for thermo-chemical treatment

JB/T 9199 Technical requirements of stop-off paints

JB/T 9218 Non-destructive testing - Penetrant testing

JB/T 10175 Quality control requirement for heat treatment

3 Terms and definitions

The terms and definitions, as established in GB/T 7232, GB/T 8121, GB/T 13324, as well as the following terms and definitions, apply to this standard.

3.1

Parts for nitrocarburizing

Workpieces, which are machined or subjected to appropriate preliminary heat treatment, in preparation for nitrocarburizing.

3.2

Nitrocarburized parts

The workpiece after gas nitrocarburizing treatment is completed.

3.3

Nitrocarburizing layer

6.1.4 The atmosphere in the furnace can be adjusted. The exhaust gas shall be fully burned.

6.1.5 The furnace shall be equipped with a device to prevent overheating.

6.2 Temperature measurement & control device

6.2.1 The temperature measurement and temperature control device shall comply with the provisions of JB/T 10175.

6.2.2 The heating chamber of the periodic furnace AND each heating zone of the continuous furnace shall be equipped with its own automatic temperature control and recording device.

6.2.3 Within the predetermined processing temperature range, the total temperature error, which is indicated by the instrument, shall not exceed $\pm 3\text{ }^{\circ}\text{C}$.

6.3 Maintenance of equipment

Equipment shall be regularly repaired, according to requirements, to maintain the normal state of the equipment. It shall keep its maintenance records.

6.4 Commonly used penetrants

The technical indicators of the penetrants shall comply with the provisions of JB/T 9209.

6.4.1 Organic compounds, which contain nitrogen and carbon atoms, such as triethanolamine, formamide, etc., can be used alone or together with other organic compounds.

6.4.2 Use the ammonia as main gas. Add any kind of gas, such as alcohol cracking gas, carbon dioxide, endothermic atmosphere, exothermic atmosphere. The quality of ammonia gas shall meet the requirements of the first-class products in GB 536-1988.

7 Gas nitrocarburizing treatment

7.1 Preparation before processing

7.1.1 Confirm the technical requirements of the parts for nitrocarburizing, including the nitrocarburized location, the nitrocarburized depth, the surface hardness, the metallographic structure, etc.

7.1.2 Use appropriate methods to remove oil stains and rust spots, on the surface of the parts for nitrocarburizing.

7.1.3 Parts for nitrocarburizing, which is to be subject to partial nitrocarburizing, shall be treated with anti-seepage treatment. The anti-seepage agent shall comply with the provisions of JB/T 9199.

7.1.4 Perform stress relief treatment on slender, thin-walled precise parts for nitrocarburizing. The treatment temperature is generally 20 °C higher than the nitrocarburizing temperature; it shall be kept for a sufficient time; the anti-oxidation measures shall be taken.

7.1.5 Select process equipment; check piping system, heating equipment, control instruments, etc.

7.1.6 The specimens for testing shall be placed together with the furnace. The material, pretreatment, processing conditions of the specimens shall be the same as the parts for nitrocarburizing.

7.2 Furnace loading

7.2.1 When using the material basket (fixture), it shall check its safety performance in advance; remove oil stains.

7.2.2 The workpiece shall be installed in the effective heating area. Pay attention to the furnace loading method, loading amount, loading position, mutual gap of the workpiece and the specimen; prevent the distortion of the workpiece; ensure a good circulation of the atmosphere in the furnace.

7.3 Gas nitrocarburizing process

7.3.1 The heating rate, nitrocarburizing temperature, atmosphere composition, nitrocarburizing time shall be set and controlled, according to the material and technical requirements of the workpiece.

7.3.2 During the treatment process, attention shall be paid to the fluctuation of furnace temperature and the amount of infiltration agent added; the exhaust speed should be fast after entering the furnace; preheating measures can be taken, if necessary.

7.3.3 The commonly used nitrocarburizing temperature is 520 °C ~ 570 °C.

7.3.4 The commonly used nitrocarburizing time is 2 h ~ 4 h.

7.4 Cooling

7.4.1 Oil is usually used as the coolant. Other coolants can also be selected, according to technical requirements.

7.4.2 If the surface color is required, the cooling process after nitrocarburizing shall be carried out, in a nitriding atmosphere or other protective atmosphere.

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