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High Speed Precision Hot Upsetting Forgings - Technological Specification

高速精密热镦锻件 工艺规范

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Table of Contents

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1 Scope

This Standard stipulates the technological specification of high speed precision hot upsetting forgings (hereinafter referred to as “forgings”), including general principles, determination of technological parameters, preparation of forging billets, billet heating, requirements of moulds and selection of equipment.

This Standard is applicable to the technological design for steel precision forgings which adopt hot upsetting for molding, and with the production pace of 50 PCS/min and above, the mass of below 7.5 kg, and the outer diameter of not more than 180 mm.

2 Normative References

The following documents are indispensable to the application of this document. In terms of references with a specified date, only versions with a specified date are applicable to this document. In terms of references without a specified date, the latest version (including all the modifications) is applicable to this document.

GB/T 699 *Quality Carbon Structural Steels;*

GB/T 700 *Carbon Structural Steels;*

GB/T 1299 *Tool and Mould Steels;*

GB/T 1591 *High Strength Low Alloy Structural Steels;*

GB/T 3077 *Alloy Structure Steels;*

GB/T 5216 *Structural Steels with Specified Hardenability Bands;*

GB/T 8541 *Terminology of Forging and Stamping;*

GB 13318-2003 *General Rules for Safety and Environmental Conservation of Forging Production;*

GB/T 15712 *Micro-alloyed Medium Carbon Steels;*

GB/T 18254 *High-carbon Chromium Bearing Steel;*

GB/T 28417 *Carbon Bearing Steel;*

4.1.7 Mould parts that contact forgings shall be cooled down. Generally speaking, the cooling medium of moulds shall select water. Avoid directly spraying forgings with the cooling medium.

4.1.8 In terms of forgings with a relatively large amount of deformation, proper lubricating agent should be added to the cooling medium.

4.1.9 The replacement of moulds should be conducted in sets.

4.1.10 Post-forging afterheat should be utilized in the thermal treatment of forgings.

4.1.11 During the whole production process, consider adopting anti-collision measures for forgings.

4.1.12 The operating environment shall comply with the requirements in 5.2 in GB 13318-2003; personnel shall satisfy the requirements in 10.2 in GB 13318-2003; safety and environmental protection technological measures shall comply with the requirements in Chapter 9 in GB 13318-2003.

4.2 Determination of Technological Parameters

4.2.1 Deformation temperature

4.2.1.1 Deformation temperature shall be within the Austenite zone, which is above the recrystallization temperature. In order to avoid over-heating and over-burning phenomena, heating temperature should be within 1,150 °C ~ 1,280 °C. Specifically speaking, heating temperature of bearing steel should not exceed 1,180 °C. On the premise of thorough cooling of moulds, the heating temperature should approach the upper limit.

4.2.1.2 After forging, the temperature should be quickly cooled down to below A_{C1}, so as to avoid grain growth.

4.2.1.3 When afterheat is utilized for thermal treatment, the final forging temperature of forgings shall satisfy the requirements of the subsequent thermal treatment.

4.2.2 Degree of deformation

4.2.2.1 Degree of deformation of the various stations shall avoid large grains caused by final accumulative deformation.

4.2.2.2 The selection of the degree of deformation shall consider the influence of deformation mode on allowable deformation.

4.2.3 Deformation force

Numerical value simulation should be adopted to analyze and calculate deformation force, or, nomograph or empirical formula may also be adopted for calculation. 4.2.1.7

4.4 Billet Heating

4.4.1 Billet heating shall adopt the mode of integral-bar induction heating. Furthermore, there shall be temperature detection; high and low temperature alarm and shutdown functions.

4.4.2 The selection of the specification of the sensor shall match with the diameter of the heating billets, so as to avoid low efficiency of heating.

4.4.3 The billet feeding pace shall comprehensively consider factors like billet dimensions, heating temperature and forging equipment, etc. It shall be on the premise that the heating temperature of billets shall evenly reach the technological requirement.

4.5 Requirements of Mould

4.5.1 The precision of moulds shall satisfy precision requirements of forgings, such as: dimensions, shape and position tolerances, etc.

4.5.2 Convex mould, concave mould and ejector pole should adopt nitridation for surface treatment, so as to enhance the surface hardness and abrasive resistance of moulds. The surface roughness value of moulds shall be not more than Ra0.8 μm.

4.5.3 Concave mould and ejector pole should be designed into hollow structure, so that the coolant can cool down the concave mould.

4.5.4 Convex mould and concave mould of closed molding station shall have a guide structure. The bilateral matching clearance should be controlled within 0.10 mm ~ 0.30 mm.

4.6 Selection of Equipment

4.6.1 Equipment's force-stroke curve and energy shall satisfy the requirements of the force-stroke curve and deformation work of the molding of forgings.

4.6.2 Equipment precision shall comply with the relevant stipulations in GB/T 29532.

4.6.3 The selection of equipment shall consider the actual output demand for forgings, the load of the various stations, the allowable eccentric load and the cost of production, etc.

4.6.4 Equipment shall be equipped with material head and material tail automatic detection and rejection system. The requirements for the precision, stability and reliability of the mechanical arm transmission system; the efficiency of the cooling system for moulds; the internal cooling of moulds; the quick replacement of moulds and the reliability of the ejecting device shall be considered.

4.6.5 An automatic production line should be built, which mainly includes feed

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