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Guide for simulation and modeling of thermal processing

热加工工艺仿真与模拟技术导则

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Table of Contents

Foreword

This instructional document has been drafted in accordance with the rules given in GB/T 1.1-2009. This Guidance Document is proposed by China Machine Tool Productivity Center. This Guidance Document is governed by the National Technical Product Documentation Standardization Technical Committee (SAC/TC146). The main drafting unit of this technical guidance document is. Machine Productivity Promotion Center, State Key Laboratory of Advanced Forming Technology and Equipment, Tsinghua University. The main drafters of this technical guidance document. Ding Hongyu, Jinquan Lin, Zhang Yan Shu, Zeng Pan, Lin Feng, Zhang Xiufen, Liu Wei. Thermal processing technology simulation and simulation techniques

1 Scope

This guiding technical document specifies the meaning of simulation and modelling technology for hot working processes, the principles by which its scales are divided, its main functions and its main content; puts forward the common requirements as to accuracy and speed, physical simulation and precise testing, and integration; and gives an explanation of the main technical content, the main steps and the key factors of the simulation and modelling of casting, forging and welding processes. This guiding technical document applies to the research, development, application and assessment of simulation and modelling technology for the hot working processes of materials.

This Guidance Document specifies the meaning of thermal process simulation and simulation technology, principles of scale division, main functions, main contents, The accuracy and speed, physical simulation and precision testing, integration of the common requirements, and gives the casting, forging and welding process simulation and Simulation of the main technical content, the main steps and key elements of the description. This guideline is applicable to the research, application and evaluation of simulation and simulation of materials thermal processing technology.

2 Thermal processing simulation and simulation overview

Thermal processing simulation and simulation technology refers to the application of simulation, test and other means, for metal casting, forging, welding, Heat treatment and non-metallic materials, injection molding and other thermal processing process, in a realistic environment to simulate the material processing technology process, showing the material in the process In the shape, size, internal organization and defects of the evolution of the prediction of its organizational performance and quality, to optimize the process design technology in general. It involves the main technologies include.

a) Numerical simulation of thermal processing By establishing a mathematical model that accurately describes a thermal processing process and simplifying the mathematical equations, the process is dynamically displayed And predict the result.

b) Physical simulation of thermal processing Is a necessary verification method. It is based on similar principles, using the same or similar materials made of the sample, under similar conditions Line test, draw the law of the process and data, criteria, and test, check the results of numerical simulation.

c) Expert system The relevant expert knowledge by a certain logical structure expressed in the form of computer can use to optimize process parameters and design. general Including knowledge base, logical reasoning judgment system and man-machine interface 3 core parts. It is also true because of the complexity of thermal processing An effective supplement to numerical simulation.

d) Thermal processing of the basic theory and analysis of defect formation It is to accurately establish the mathematical model of the process, get the scientific basis for the scientific basis of defects.

3 thermal processing simulation and simulation of the scale division

Divided into macroscopic (mm-m level), micro (μm-mm level), atom (nm-m level) three different simulation scale.

--- Macroscopic (mm-m level) General purpose to predict the shape, size and other dimensions of the macro-scale for the purpose.

--- Microscopic (μm-mm level) Generally to predict the organization, structure, performance for the purpose.

--- Atoms (nm-μm grade) generally to predict the organization, structure, performance for the purpose.

4 thermal processing numerical simulation of the main functions

4.1 dynamic simulation process Image shows the process of implementation of various processes and material shape, contour, size, defects, organizational evolution.