Research and Application on Medium-Carbon Microalloyed High-Strength Steel

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Abstract: The thermal-simulation tests of medium-carbon microalloyed steels have been carried on by Gleeble-2000 thermal-simulation machine. How the chemical component, deformation temperature, cooling conditions after rolling effect on structure and property has been studied. The CCT curves have been determined. The strengthening-roughing mechanism of medium-carbon microalloyed structural steels has been researched deeply. According to the experimental results, qualified products that can meet with ASTM A722-95 have been produced.

Key words: thermal-simulation machine, microalloyed, deformation temperature, cooling conditions after rolling.

1 Preface

To meet the construction requirements for large hydraulic engineering, bridge and mountain retaining projects in recent years in China, the finish-rolled high-strength reinforced bar with yield strength of 785MPa, tensile strength of 985MPa and δ5%≥7% (hereinafter referred to as Bar 785) and the reinforced bar with yield strength of 835MPa, tensile strength of 1035MPa and δ10% ≥7% (hereinafter referred to as Bar 835) are studied and produced. The basic component of these two bars is 40Si2Mn and the organism structure is pearlite + ferrite. According to the actual rolling conditions in Shougang, the method of strengthening via the compound microalloy with vanadium as its main component and strict process of rolling and cooling control are applied. All the products produced can meet the customers' requirements.

2 Test Material and Method

2.1 Test Material

The chemical composition of steel is one of the important factors to determine the structure property of steel. In microalloyed steel, the elements such as Nb, V and Ti are mostly used currently. The characteristic of these elements is that they can produce carbonitride after combining with carbon and nitrogen in steel. These compounds will dissolve at high temperature while having an effect of precipitation strengthening at low temperature.

Based on the existing conditions, 40Si2MnV was selected as the basic steel, the contents of alloy elements V, Nb and the Mo which is the forming element for medium-strength carbide were properly increased. In order to improve the steel strength the corresponding cooling process was applied depending on the varieties of steel compositions. For the chemical compositions of the test steel see Table 1. The steel Grade 1 and Grade 2 with different alloy content were focused for the study. With regard to Grade 3 Mo-V was used as the main strengthening element.