

Study on Application of NV Microalloyed Steel

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Abstract: The effect of vanadium and nitrogen on the mechanical properties of 20MnSiV and 16MnV microalloyed steel grades is studied in this paper through the contrast test by adding V-Fe(51.6%V) and the American priority product NV12 (80%V, 12%N) into the 20MnSiV and 16MnV steel. The savings in content of vanadium and technological economy of the steel is also discussed.

Key Words : Nitrovan 12 alloy, microalloying, strength

1 Preface

By adding trace elements such as Nb, V and Ti into plain carbon steel or ordinary low alloyed steel, and applying technologies of rolling control and cooling control, microalloying can enable certain steel grades to achieve finer grain, better roughness, more desirable comprehensive properties of both formability and weldability, so as to attain the improved mechanical performance of the steel and reduced production cost.

Microalloying elements in steel play an important role in grain refining and precipitation strengthening, for these can form tiny dispersed particles of carbide, nitride or carbonitride to inhibit growing of austenitic grain, and the refined austenitic grain will have an effect on grain refining and precipitation strengthening. Study in recent years demonstrates that nitrogen will have significant effect on solid solution precipitation of carbonitride in microalloyed steel. The beneficial effect of nitrogen comes from the reciprocal action between nitrogen and alloying elements.

The nitrogen bearing steel is the solution to reduction of production expenses in N_2 degassing via degassing facility or other secondary refinement equipment, and still the nitrogen pick-up in steel can put microalloying elements to their full use, save the consumption of microalloying elements

and lower the production cost to the further extent.

In order to study the significance of vanadium and nitrogen in steel, Jianan Iron & Steel Group Corporation (hereinafter referred to as "Jigang") has made a series of comparison tests in production of 20MnSiV and 16MnV steel grades by adding American priority product VN12 alloy (80%V, 12%N) vs. adding FeV (51.6%) and studied the effect of V and N microalloying on properties of 20 MnSiV and 16 MnV steel grades. The tests demonstrate that by using VN12 (80%V, 12%N) in microalloying of steel, nitrogen containing in steel can be utilized to the full extent, and the mechanical performance of steel can greatly improve, which will bring about fine economic benefit.

2 Production of Test Steel and Test Methods

2.1 Production of 20MnSiV Class III Reinforced Bar

2.1.1 Process Scheme of Test Production
Take VN12 and FeV as alloying elements to respectively produce 4 different dimensions (within $\Phi 12\text{mm}\sim 32\text{mm}$) of Class III reinforced bar, each dimension with 10 heats of 20MnSiV (N) and 5 heats of 20MnSiV. Process flow is 6T Converter Steel Making – Alloying in Ladle – Wire Feeding and Argon Blowing – Billet Continuous Casting-Tandem Rolling Mill-Inspection-Stocking.